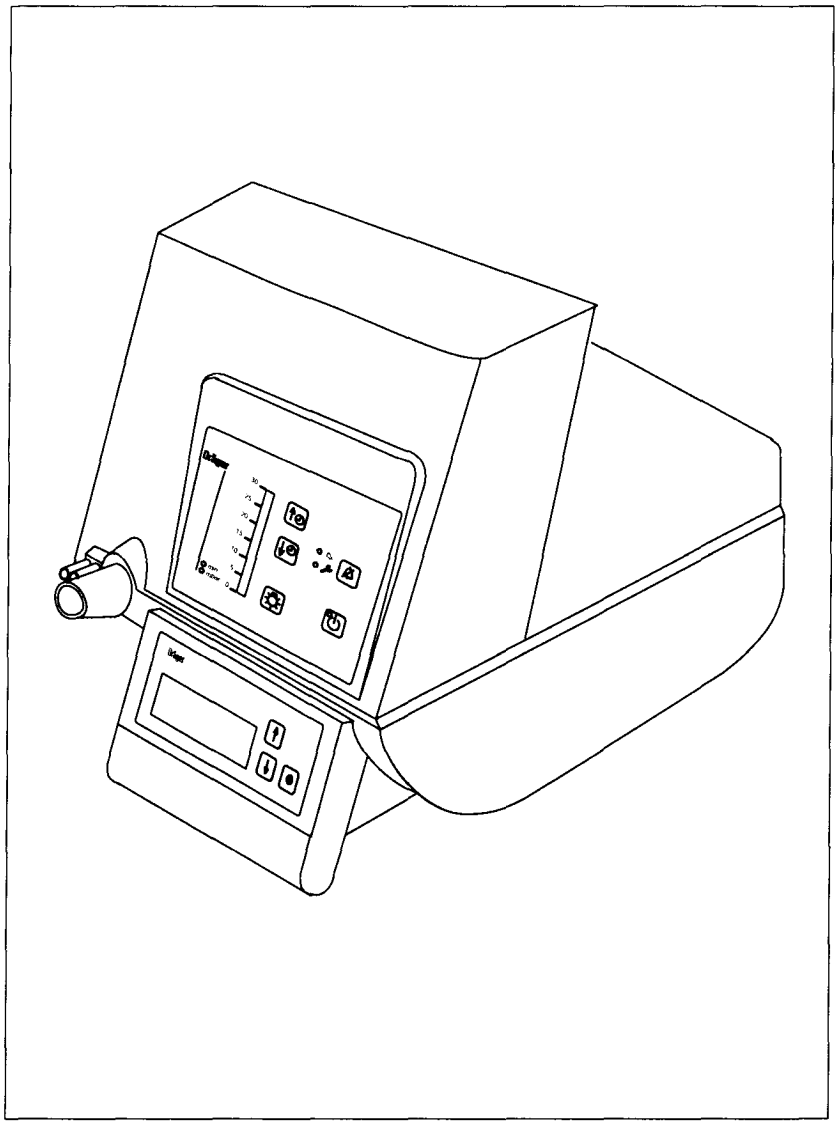
Respi Care SW 1.n

Respiration Therapy Unit

Technical
Documentation



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This technical documentation does not replace the Operating Manual.

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Reference is hereby made to the observance of the relevant safety provisions, such as the Medical Equipment Ordinance (Medizingeräteverordnung), the Pressure Container Ordinance (Druckbehälterverordnung), the Technical Rules for Pressurised Gases (Technische Regeln Druckgase) or the Occupational Health and Safety Provisions (Unfallverhütungsvorschriften).

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Follow your local laws and regulations.

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1 About This Service Manual

This Service Manual conforms to the International Standard IEC 60601-1.

Read each step in every procedure thoroughly before beginning any test. Always use the proper tools and specified test equipment. If you deviate from the instructions and/or recommendations in this Service Manual, the equipment may operate improperly or unsafely, or the equipment could be damaged.

Use only genuine spare parts and supplies from Dräger Medical AG & Co. KGaA.

The Test List in this Service Manual does not replace inspections and servicing by Dräger Medical AG & Co. KGaA.

This Service Manual does not replace the Instructions for Use.

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1.1 Definitions

This symbol is used to provide important information that, if ignored, could lead directly to a patient's or operator's injury. It is also used to provide important information that, if ignored, could lead directly to equipment damage and, indirectly, to a patient's injury.

This symbol is used to provide additional information, operating tips, or maintenance suggestions.

Inspection	=	examination of actual condition
Servicing	=	measures to maintain specified condition
Repair	=	measures to restore specified condition
Maintenance	=	inspection, service, and repair, where necessary

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2 For Your Safety and that of Your Patients

2.1 Strictly follows the Instructions for Use

Any use of the apparatus requires full understanding and strict observation of these instructions. The apparatus is only to be used for purposes specified here.

2.2 Maintenance

The apparatus must be inspected and serviced regulary by trained service personnel at yearly intervals 8and a record kept).

Repair and general overhaul of the apparatus may only be carried out by trained service personnel. We recommend that a service contract be obtained with DrägerService® and that all repairs also be carried out by them. Only authentic Dräger spare parts may be used for maintenance.

Observe chapter "Maintenance Intervals".

2.3 Accessories

Do not use accessory parts other than those in the order list.

2.4 Not for use in areas of explosion hazard

This apparatus is neither approved nor certified for use in areas where combustible or explosive gas mixtures are likely to occur.

2.5 Safe connection with other electrical equipment

Electrical connections to equipment which is not listed in the Instruction for Use should only be made following consultations with the respective manufacturers or an expert.

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2.6 Liability for proper function or damage

The liability for the proper function of the apparatus is irrevocably transferred to the owner or operator to the extent that the apparatus is serviced or repaired by personnel not employed or authorized by DrägerService® or if the apparatus is used in a manner not conforming to its intended use.

Dräger Medical AG & Co. KGaA cannot be held responsible for damage caused by non-compliance with the recommendations given above. The warranty and liabililty provisions of the terms of sale and delivery of Dräger Medical AG & Co. KGaA are likewise not modified by the recommendations given above.

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3 Intended Use

RespiCare®[1] therapy unit for non-invasive ventilation with nasal mask, mouth mask or mouth-and- nose mask. For patients who can breathe spontaneously but require temporary respiratory support or controlled ventilation.

For sleep apnoea therapy,
for weaning long-term ventilation patients and
for disorders of the respiratory muscles.

For use

- in hospitals
- in sleep laboratories
- at home
- for stationary or mobile use in vehicles and wheelchairs.

3.1 Variants of RespiCare

There are three variants of the RespiCare:

3.1.1 RespiCare N

- CPAP (Breathing with continuous positive pressure in the airways).

3.1.2 RespiCare S

- CPAP (Breathing with continuous positive pressure in the airways).
- CPAP/ASB (Spontaneous breathing with synchronized assistance).

With disconnection/stenosis alarm.

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3.1.3 RespiCare SC

- CPAP (Breathing with continuous positive pressure in the airways).
- CPAP/ASB (Spontaneous breathing with synchronized assistance).
- PCV (Pressure controlled ventilation).
- PCV S (Pressure controlled ventilation with synchronized inspiration phase).
- PCV + (Spontaneous breathing with controlled changeover between two pressure levels).

With disconnection/stenosis alarm.

Warning:

Risk of personal injury to the patient. The RespiCare must not be used for life-saving functions or for treating patients requiring mandatory ventilation.

Risk of malfunction. Mobile phones may impair the function of electromedical equipment and be a risk to the patient's safety. **Do not use mobile phones within 10 meters of the the RespiCare.**

Risk of explosion. Do not use the RespiCare in explosion-hazard areas.

The RespiCare may only be used as prescribed by a doctor and with the settings specified by the doctor.

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4 Maintenance Intervals

Warning:

Risk of infection due to contamination with infectious body fluids. To avoid infection, **clean and disinfect the Gerätename and/or its components before servicing (and before returning it/them for repair) according to approved hospital procedures and the instructions given in this service manual.**

Coarse dust filter	• Clean the coarse dust filter every three weeks. • If the coarse dust filter is damaged, replace it with a new one. • Replace the coarse dust filter at the latest after 6 months of application. • Dispose of the coarse dust filter as household waste.
Fine dust filter	• Replace the fine dust filter after 500 hours of application. • Replace the fine dust filter at the latest after 6 months of application. • Dispose of the fine dust filter as household waste.
Inspection and maintenance	• If the yellow LED for service required comes on, have the device inspected and maintained by qualified service personnel. • Have the device inspected and maintained by qualified service personnel every 12 months.

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5 Check Readiness for Operation

- The RespiCare readiness for operation must be checked whenever it has been cleaned and disinfected.

After assembling the RespiCare is ready for operation.

- Plug the RespiCare power cord into the mains socket-outlet.
- Switch on the RespiCare by pressing the mains switch (located on the rear side).

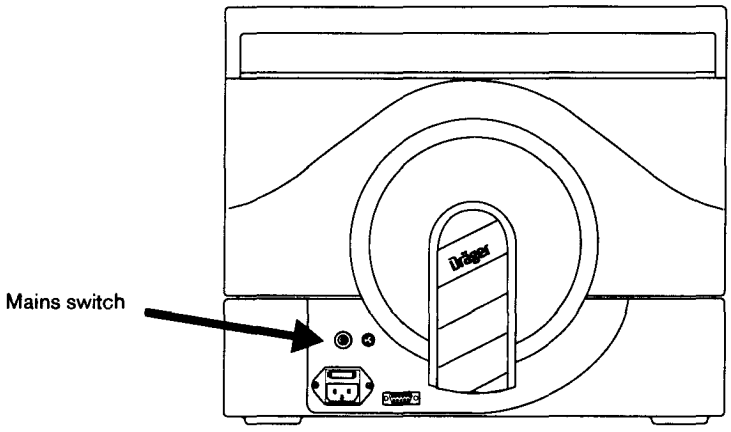

Fig. 1: Rear view of the RespiCare, pressing the mains switch

The Control panel is located on the front side of the RespiCare.

- Turn the RespiCare.

All LEDs light up for a short moment and an audible alarm sounds.

The green LED in button (1) lights up, see figure below.

- Press the button (2).

The LED "min" (3) lights up. The time for soft start is shown on the strip LEDs (4) in minutes.

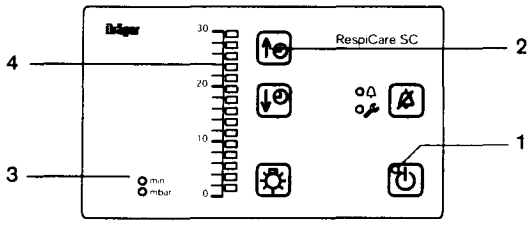

Fig. 2: Control panel of the RespiCare

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- Set the time for the soft start function to zero by pressing the button (1).
- Put on a suitable nasal mask.
- Press the button (2).

The RespiCare is switched on.

- Press the button (3).

The LED "mbar" (4) lights up. The set airway pressure must appear on the strip LEDs (5).

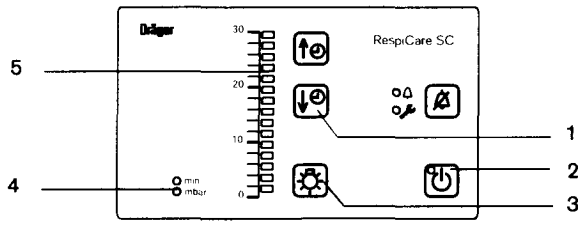

Fig. 3: Control panel of the RespiCare

- Press the button (6), see figure below.

The green LED in button (6) lights up. The RespiCare is in the standby mode.

- Press the button (7) or (8) and set the time for the soft start.

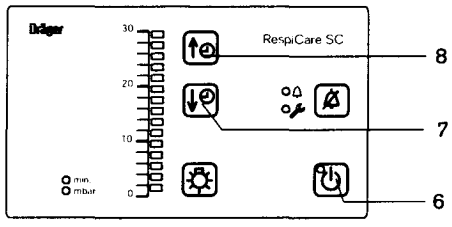

Fig. 4: Control panel of the RespiCare

The RespiCare is now ready for use.

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6 Cleaning/disinfection in the hospital

Use surface disinfectants. For reasons of material compatibility we recommend using only disinfectants based on

- aldehydes;
- alcohol; or
- quaternary ammonium compounds.

Caution:

Risk of damage to materials when using disinfectants based on phenols, halogen-releasing compounds, strong organic acids, oxygen-releasing compounds. **Do not use disinfectants based on phenols, halogen-releasing compounds, strong organic acids, oxygen-releasing compounds.**

6.1 Disinfecting the Operator Control Module, the Basic Unit and the Power Cord

- Disconnect the power cord of the RespiCare from the socket-outlet.
- Wipe-disinfect the operator control module, the basic unit, and the power cord using, for example, Buraton 10 F (made by Schülke & Mayr, Norderstedt/Germany).
  Important: Strictly follow the manufacturer's instructions.

Caution:

Risk of damage to the electronics. Liquids in the connections may damage the electronics. Make sure no liquids get on the connections of the RespiCare.

6.2 Cleaning/Disinfecting the Nasal Mask

- Clean/disinfect the nasal mask in accordance with the separate Instructions for Use.

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6.3 Disinfecting the Ventilation Hose, Test Hoses Including E-Vent Test Outlet, and Oxygen Adapter

- Disconnect the power cord of the RespiCare from the socket-outlet.

6.3.1 Disinfecting in Automatic Washing and Disinfection Machine

- Disinfect in hot liquid (93 °C/10 minutes) in an automatic washing and disinfection machine - **with detergent only.**

6.3.2 Disinfecting Without Automatic Washing and Disinfection Machine

- Disinfect the ventilation hose, the test hoses with E-Vent and the oxygen adapter e.g. with Helipur (made by Braun, Melsungen/Germany).
  Important: Strictly follow the manufacturer's instructions.
- Then rinse the ventilation hose, the test hoses with E-Vent and the oxygen adapter in clear water (preferably from the soft water trap).
- Thoroughly shake off all remaining water.
- Allow the ventilation hose, the test hoses with E-Vent and the oxygen adapter to dry completely.

Caution:

Risk of malfunction. Remaining water in the test hoses and connectors may impair the RespiCare correct operation. **Check that no water is in the test hoses and the connectors.**

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7 Cleaning/Disinfecting at Home

7.1 Cleaning/Disinfecting the Basic Unit and the Power Cord

- Disconnect the power cord of the RespiCare from the mains socket-outlet.
- Remove any dirt with a disposable cloth.

Caution:

Risk of malfunction. Remaining water in the test hoses and connectors may impair the RespiCare correct operation. **Check that no water is in the test hoses and the connectors.**

7.2 Cleaning/Disinfecting the Ventilation Hose, Test Hoses Including E-Vent Test Outlet, and Oxygen Adapter

- Wash the ventilation hose, test hoses with E-Vent test outlet, and oxygen adapter thoroughly in warm soapy water.
- Rinse the ventilation hose, test hoses with E-Vent test outlet, and oxygen adapter under running water.
- Place the ventilation hose, test hoses with E-Vent test outlet, and oxygen adapter in a solution of one part wine vinegar and two parts water for approx. 30 minutes.
- Rinse the ventilation hose, test hoses with E-Vent test outlet, and oxygen adapter under running water.
- Shake hoses to drain off all water.

Caution:

Risk of malfunction. Remaining water in the test hoses and connectors may impair the RespiCare correct operation. **Check that no water is in the test hoses and the connectors.**

- Allow the ventilation hose, the test hoses with E-Vent and the oxygen adapter to dry completely.
- Assemble the RespiCare.

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8 Technical Data

8.1 Operating Parameters

Rated voltage	100 V to 240 VAC, ±10% 50/60 Hz
Power consumption	maximum 100 W
Device fuse	Slow-blow T 2 H 250V, IEC 127-2/V
Classification as per EN 60601-1	Protection class II
Sound pressure (Sound pressure at 10 mbar Free-field measurement over a reflcting surface, distance 1 meter)	maximum 40 dB(A)

8.2 Ambient Conditions In Operation

Temperature	
RespiCare N	+5 °C to +40 °C
RespiCare S/SC	+5 °C to +35 °C
Air pressure	600 to 1100 hPa
Relative humidity	10 to 95%, no condensation

8.3 Ambient Conditions In Storage

Temperature	–20 °C to +70 °C
Air pressure	600 to 1200 hPa
Relative humidity	10 to 95%, no condensation

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8.4 Settings, RespiCare N

Ventilation mode

CPAP

Airway pressure	3 mbar to 20 mbar
Time for soft start function	0 to 30 minutes

8.5 Settings, RespiCare S

Ventilation modesi

CPAP

Airway pressure	3 mbar to 20 mbar

CPAP/ASB

Inspiration pressure (Pinsp)	5 mbar to 30 mbar
Expiration pressure (Pexsp)	2 mbar to 20 mbar
Trigger sensitivity (Trigg.I)	5 settings (approx. 10 to 50 L/min)
Trigger sensitivity (Trigg.E)	5 settings (approx. 15 to 75 L/min below peak flow)
Ramp	6 settings (0 to 0.5 seconds)
Time for soft start function	0 to 30 minutes

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8.6 Settings, RespiCare SC

Ventilation modes

CPAP

Airway pressure	3 mbar to 20 mbar

CPAP/ASB

Inspiration pressure (Pinsp)	5 mbar to 30 mbar
Expiration pressure (Pexp)	2 mbar to 20 mbar
Trigger sensitivity (Trigg.I)	5 settings (approx. 10 to 50 L/min)
Trigger sensitivity (Trigg.E)	5 settings (approx. 15 to 75 L/min below peak flow)
Ramp	6 settings (0 to 0.5 seconds)
time for soft start function	0 to 30 minutes

PCV (S)

Inspiration pressure (Pinsp)	5 mbar to 30 mbar
Expiration pressure (Pexp)	2 mbar to 20 mbar
Trigger sensitivity (Trigg.I)	5 settings (approx. 10 to 50 L/min)
Ramp	6 settings (0 to 0.5 seconds)
Ventilation frequency (Freq)	2 to 60 1/min (bpm)
Insp. respiration phase (%Insp)	20% to 66%

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PCV

Inspiration pressure (Pinsp)	5 mbar to 30 mbar
Expiration pressure (Pexp)	2 mbar to 20 mbar
Insp. respiration phase (%Insp)	20% to 66%
Ventilation frequency (Freq)	2 to 60 1/min (bpm)
Ramp	6 settings (0 to 0.5 seconds)

PCV (+)

Pressure level (P-high)	5 mbar to 30 mbar
Pressure level (P-low)	2 mbar to 20 mbar
Time (T-high)	1 to 60 seconds
Time (T-low)	1 to 60 seconds
Trigger sensitivity (Trigg.I)	5 settings (approx. 10 to 50 L/min)
Trigger sensitivity (Trigg.E)	5 settings (approx. 15 to 75 L/min below peak flow)
Ramp	6 settings (0 to max. 50% of T-high)
Time for soft start function	0 to 30 minutes

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8.7 Device Parameters

Device compliance with patient hose system	≤ 0.6 mL/mbar
Maximum pressure limit	40 mbar (on patient)
Inspiration and / expiration resistance	maximum 6 mbar at 60 L/min
Airway pressure measurement	
Range	0 to 30 mbar
Resolution	2 mbar
Accuracy	±2 mbar
Monitors	
Disconnection/stenosis alarm	Triggered when alarm limit is exceeded for at least 5 seconds. Alarm limit for airway pressures >10 mbar: actual value at least 5 mbar below set value. Alarm limit for airway pressures ≤10 mbar: actual value less than 50% of set value. The alarm is suppressed for approx. 1 minute after switching on the fan and when changing the ventilation mode.

8.8 Airway Pressure Output Paw (t)

Output voltage	40 mV/mbar (0 mbar = 0.9 V)
Load impedance	> 100 kOhm
wiring	brown = +, white = – Shield connected to plug housing

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8.9 Electromagnetic Compatibility EMC

Electromagnetic Compatibility EMC	Tested to EN 60 601-1-2

8.10 Mechanical Data

Dimensions (W x H x D)

Basic Unit	260 x 210 x 260 mm
Operator Control Module	150 x 65 x 75 mm

Weight

Basic Unit	4.2 kg
Operator Control Module	0.25 kg

Connection for ventilation hose	Dia. 22 **not tapered**

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1 RespiCare N

The RespiCare N is a nasal respiration therapy unit. The RespiCare N is for patients with spontaneous breathing.

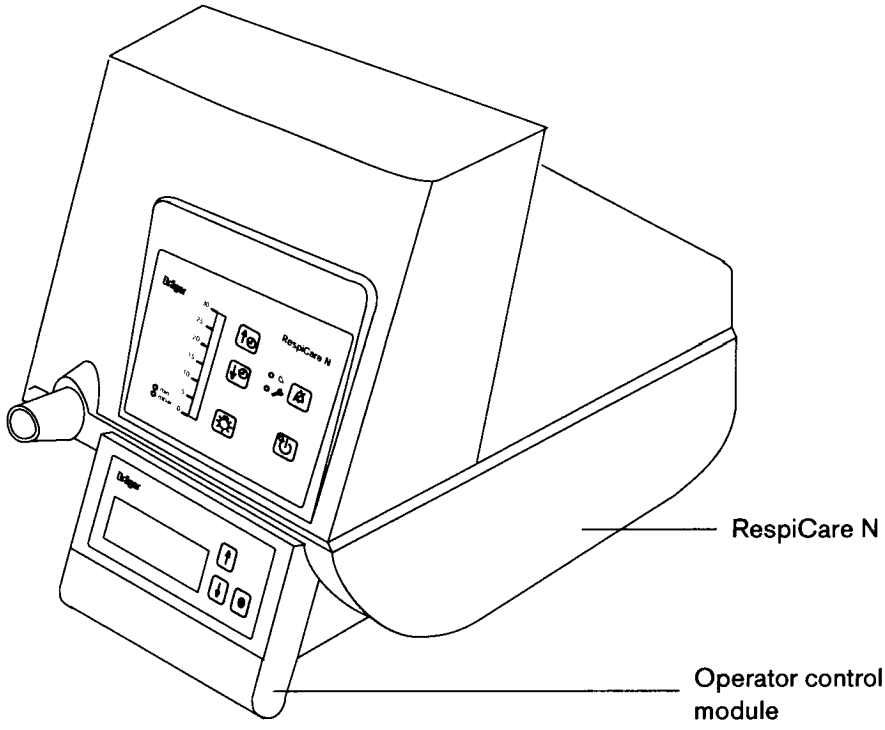

Fig. 1: View of the RespiCare N

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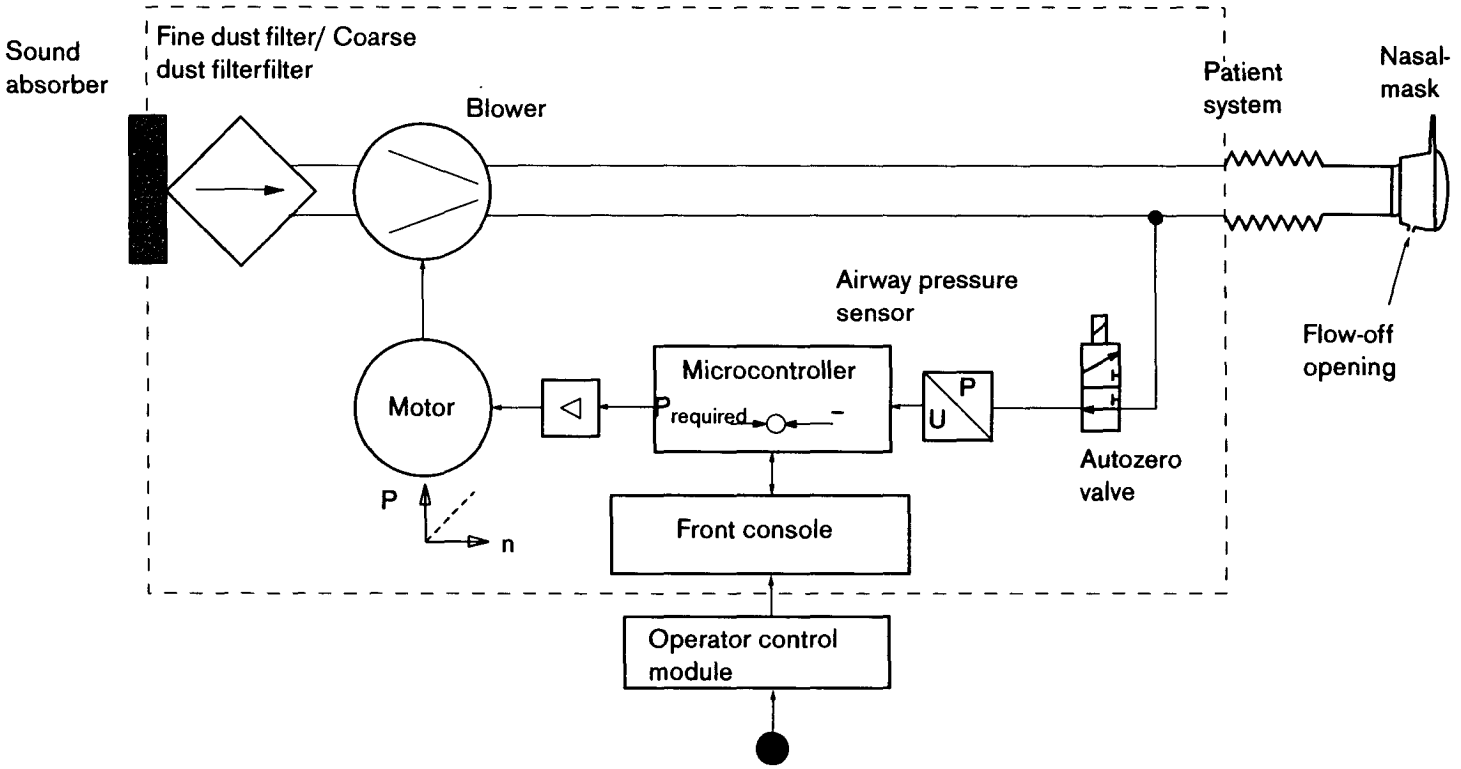


Fig. 2: Function diagram, RespiCare N

1.1 Mode of functioning of the RespiCare N

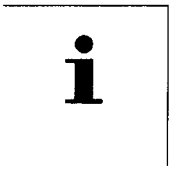
The inducted ambient air is passed through a fine dust filter/coarse dust filter and is compressed according to the pre-set ventilation pressure.

The blower delivers a patient flow of at least 60 l/min at an airway pressure of 20 mbar.

The upper pressure level set for the patient limits the rotational speed of the blower.

The airway pressure sensor measures the airway pressure (Paw). The airway pressure is visually displayed on the strip display.

A flow-off opening in the nasal mask permits gas exchange from the patient system.



In the event of blower motor failure, continued spontaneous breathing of the patient is possible.

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1.2 Operating mode of the RespiCare N

The operating mode of the RespiCare N is CPAP.

1.2.1 CPAP

CPAP is a spontaneous breathing with a positive airway pressure.

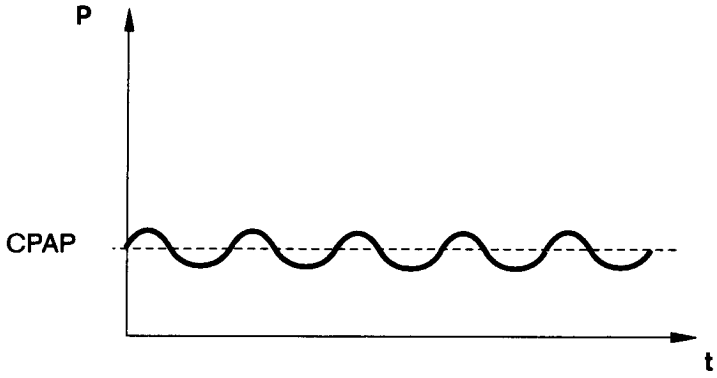

Fig. 3: CPAP curve diagram

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1.3 RespiCare N

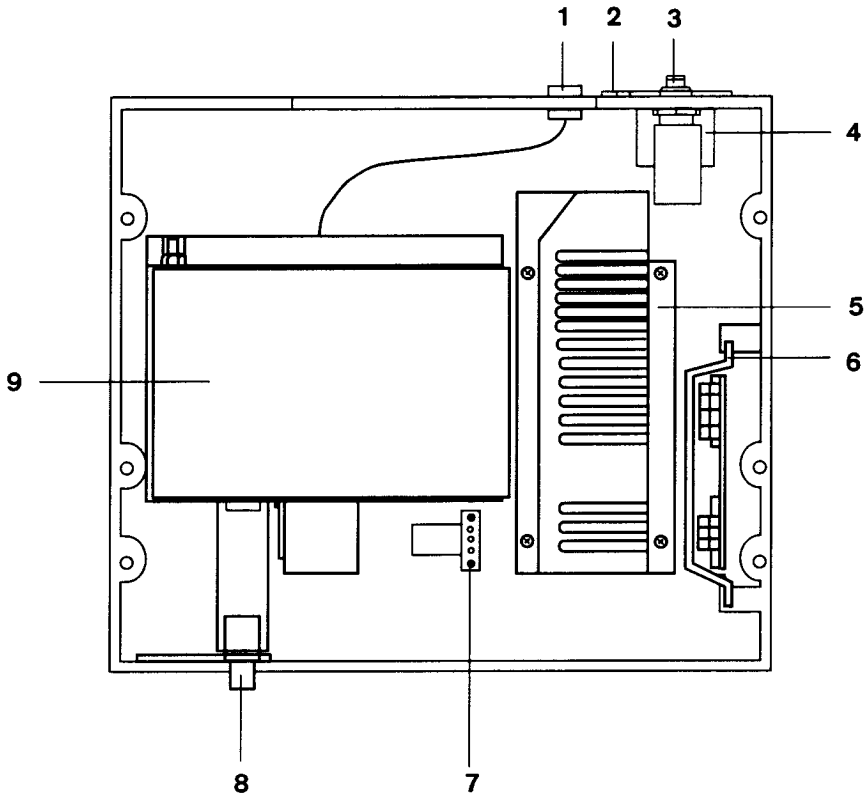

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Fig. 4: Component layout on floor of RespiCare N

Legend

1	Operator control module connecting port
2	Analog port (Paw)
3	Mains switch
4	Mains fuse
5	Power pack
6	Motor actuator
7	Autozero valve
8	Patient connecting port
9	Blower motor

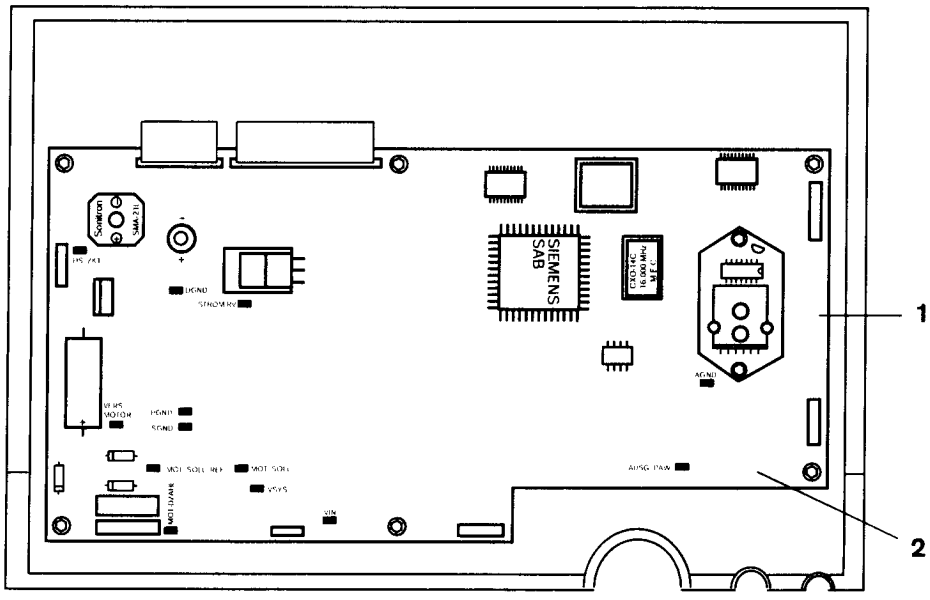

Fig. 5: Component layout in lid of RespiCare N

Legend

1	Control PCB
2	Front console (in the front)

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1.4 Components of the RespiCare N

The RespiCare N comprises the following components:

- On/off switch
- Mains fuse
- Power pack
- Control PCB
- Motor actuator
- Blower motor
- Front console
- Autozero valve
- Operator control module.

1.4.1 On/off switch

The on/off switch switches the mains power on and off respectively at two poles.

1.4.2 Mains fuse

The mains fuse protects against excessive currents in case of fault.

1.4.3 Power pack

The power pack is a switched-mode power supply unit. The mains input voltage is approx. 100 VAC to 240 VAC. The mains output voltages are approx. 13.5 VDC and approx. 24 VDC.

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1.4.4 Control PCB

The control PCB controls and monitors the functions in the RespiCare N. The airway pressure sensor (Paw) is installed on the control PCB.

The control PCB contains the following components:

- +5 VLOG generator
- Microcontroller
- Quartz
- EPROM
- Latch
- EEPROM
- Driver blocks
- D/A converters
- Airway Pressure sensor (Paw)
- Horn actuator
- Horn
- Autozero valve actuator
- Inside temperature gauge
- Reset generator
- Serial port
- Analog output (Paw).

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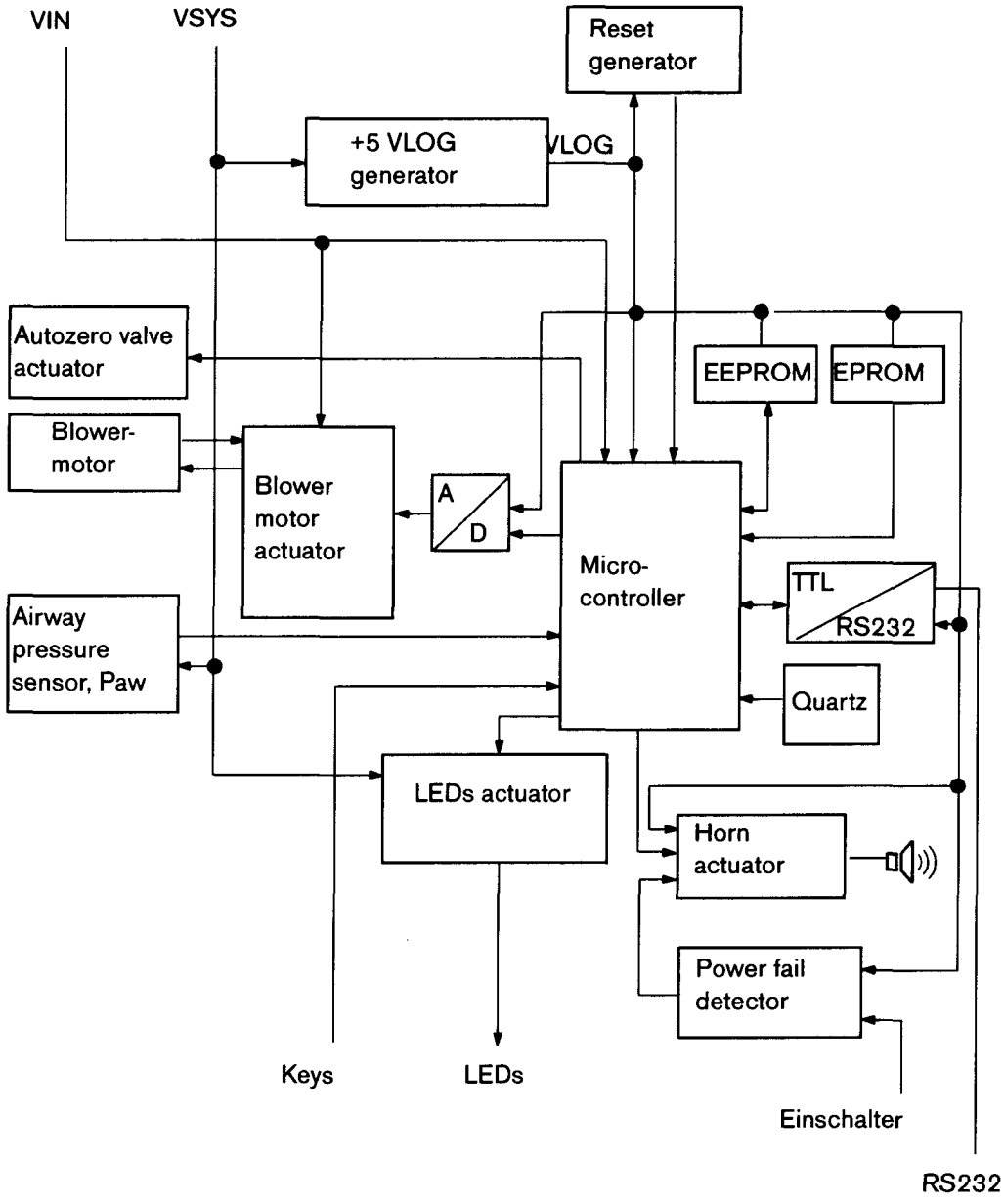

Fig. 6: Block diagram of the control PCB

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5 VLOG generator

A linear regulator generates the stabilized operating voltage of approx. 5 VDC (VLOG) from the power pack voltage of approx. 13 VDC (VSYS).

Microcontroller

The microcontroller controls and monitors the functions of the RespiCare N.

Quartz

A quartz clocks the microcontroller at a 16 MHz clock frequency.

EPROM

The EPROM contains the software program.

Latch

The data bus data (address for the EPROM) are buffered in the latch.

EEPROM

The EEPROM stores the user settings, calibration data and data of the operating time counter. The EEPROM is serially connected to the microcontroller.

Driver blocks

The actuation signals of the microcontroller are amplified with driver blocks.

D/A converters

D/A converters convert the microcontroller data into analog voltage values.

Airway pressure sensor (Paw)

The airway pressure sensor (Paw) measures the patientís airway pressure. The airway pressure sensor (Paw) converts the airway pressure into an analog voltage. The microcontroller evaluates the voltage.

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Horn actuator

The microcontroller generates an actuation signal for the horn in case of fault.

When the RespiCare N is on and the VLOG operating voltage falls, the RespiCare N generates a continuous alarm tone.

Horn

The horn is mounted on the control PCB. The horn operating voltage is 5 VLOG.

Autozero valve actuator

The microcontroller generates an actuation signal for the autozero valve every two minutes. The pulse duration is approx. 100 milliseconds.

Inside temperature gauge

A temperature sensor measures the temperature inside the RespiCare N.

If the inside temperature is higher than 65 °C the microcontroller generates an alarm.

Reset generator

The reset generator monitors the 5 VLOG operating voltage. It includes two comparators which monitor the upper and lower tolerance bands of the 5 VLOG operating voltage.

If the voltage moves outside the tolerance, the reset generator generates a reset signal on the microcontroller.

Serial port

The serial port connects the microcontroller to the RS 232 socket.

Analog output (Paw)

A separate pressure curve monitor can be connected to the analog output.

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1.4.5 Motor actuator

The motor is actuated by a four-quadrant drive. The pre-set value determines the rotational speed of the motor.

1.4.6 Blower motor

The operating voltage of the blower motor is 14 to 28 V.

1.4.7 Front console

The keys and LEDs are mounted on the front console. The keys are read by the microcontroller.

1.4.8 Autozero valve

The autozero valve vent the measuring inputs of the airway pressure sensor (Paw) every two minutes into the atmosphere.

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1.5 Operator control module

The operator control module is adaptable for the RespiCare N by means of a magnetic fixture. The operator control module includes the input unit and the LC display. The mode and patient setting parameters are set with the operator control module in the RespiCare N. The display represents the patient settings with 4x20 Characters.

The backlighting is activated when one of the three keys on the operator control module is pressed, and goes out automatically two minutes after the last press.

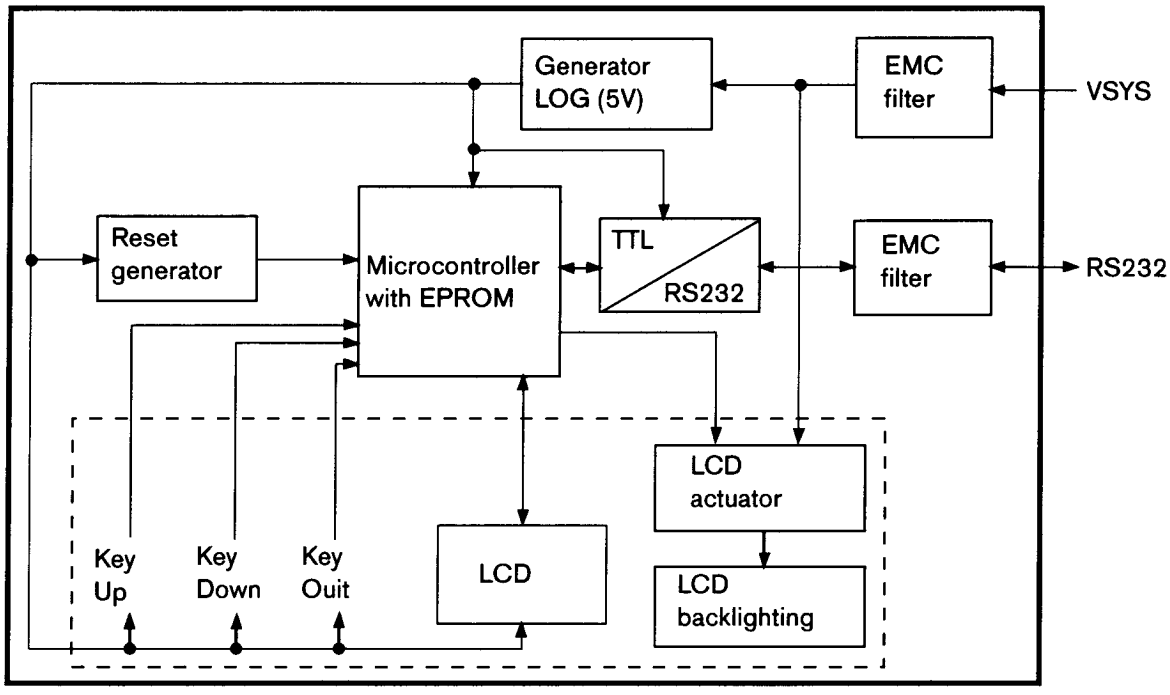

Fig. 7: Block diagram of the operator control module

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1.6 Ports

The RespiCare N has two ports.

1.6.1 Bidirectional port

A bidirectional RS 232 port permits operation of the operator control module.

1.6.2 External power connection

An external power connection allows the RespiCare N to be operated with an external voltage of 100 VAC to 240 VAC, or with a DC/AC converter (accessory).

1.7 Self-test

After power-up the RespiCare N carries out a self-test lasting approximately 5 seconds.

The following functions are tested in the self-test:

- All LEDs and displays
- Display of software version when operator control module in use
- RAM/ROM
- EPROM checksum
- Horn activation
- Voltage monitoring.

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1.8 Alarms

1.8.1 Power failure

In the event of power failure the acoustic alarm sounds. An internal power source supplies the horn with operating voltage. The acoustic alarm sounds for 120 seconds.

1.8.2 Device fault

In the event of a device fault the RespiCare N switches off the blower motor. The acoustic alarm sounds.

In the event of blower motor failure, continued spontaneous breathing of the patient is possible.

1.8.3 Inside temperature

If the inside temperature within the RespiCare N is higher than 65 °C the RespiCare N generates the technical fault "Device Malfunction" on the display of the operator control module.

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1.9 Counters

1.9.1 Total operating time

The total counter (Tot) is displayed on the operator control module. The total counter (Tot) is an absolute time counter which represents the total operating time.

1.9.2 Patient usage

The patient usage counter (Pat) is displayed on the operator control module. The blower motor running time is registered.

1.9.3 Service interval

The service interval counter (Service) is displayed on the operator control module. The Service LED (screwdriver) on the front console lights up when a service is due.

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2 RespiCare S

The RespiCare S is a nasal respiration therapy unit. The RespiCare S is for patients with spontaneous breathing capability requiring temporary assistance in breathing.

The RespiCare S allows spontaneous breathing with a continuous positive airway pressure (CPAP) and a spontaneous breathing with a continuous positive airway pressure with synchronized assistance (CPAP/ASB).

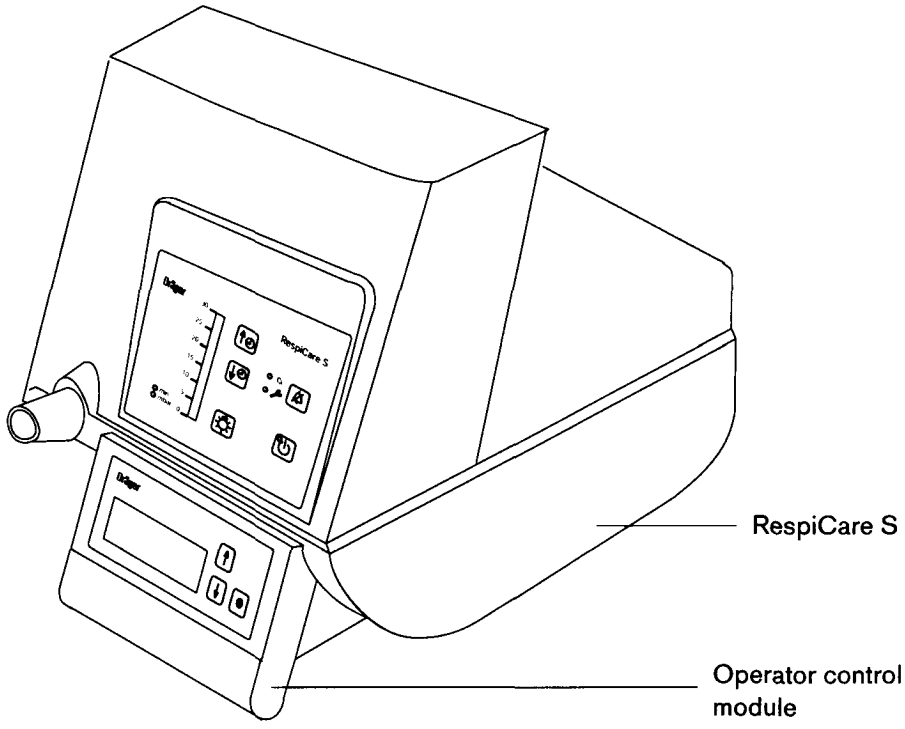

Fig. 8: View of the RespiCare S

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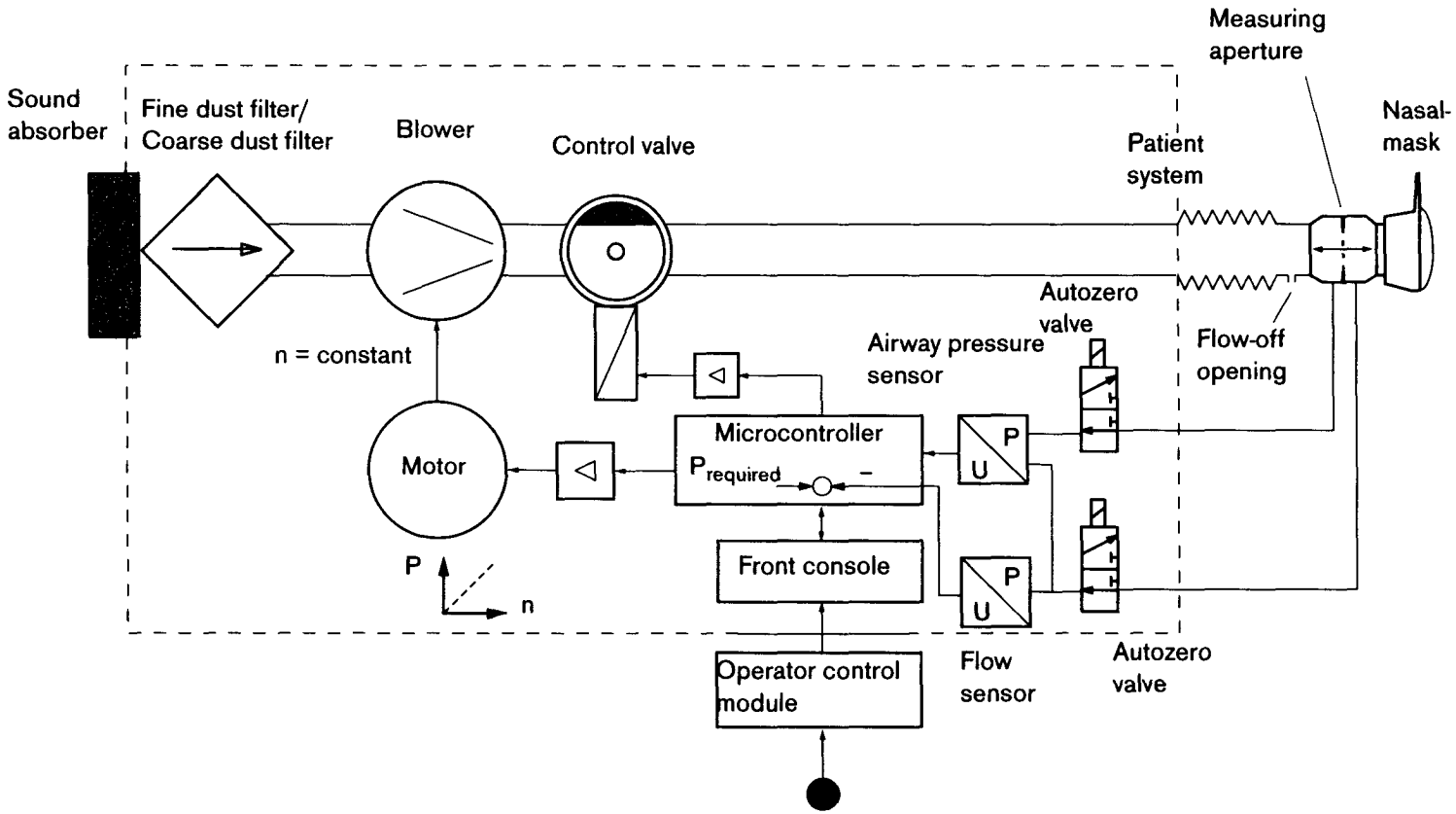


Fig. 9: Function diagram, RespiCare S

2.1 Mode of functioning of the RespiCare S

The inducted ambient air is passed through a fine dust filter/coarse dust filter and is compressed according to the pre-set ventilation pressure.

The blower motor delivers a patient flow of at least 60 l/min at an airway pressure of 30 mbar.

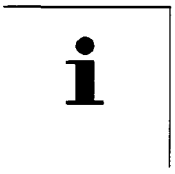
The upper pressure level set for the patient limits the rotational speed of the blower.

A control valve controls the pressure levels. The microcontroller controls the opening and closing of the control valve dependent on the airway pressure (Paw). The steepness of the pressure rise can be varied with the actuation speed of the control valve.

A bidirectional flow detector measures the patient flow and detects triggering of patient respiration.

The airway pressure sensor measures the airway pressure (Paw). The airway pressure is visually displayed on the strip display.

A flow-off opening in the measuring aperture permits gas exchange from the patient system.



In the event of blower motor failure, continued spontaneous breathing of the patient is possible.

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2.2 Operating modes of the RespiCare S

The operating modes of the RespiCare S are CPAP and CPAP/ASB.

2.2.1 CPAP

CPAP is a spontaneous breathing with a positive airway pressure.

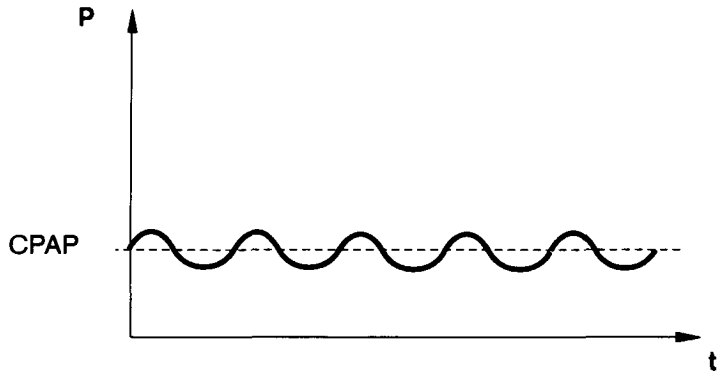

Fig. 10: CPAP curve diagram

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2.2.2 CPAP/ASB

CPAP/ASB is an assisted spontaneous breathing with adjustable pressure support.

The inspiratory or expiratory flow is triggered by the pre-set inspiration or expiration pressure, as appropriate.

If the expiratory flow is not triggered, the RespiCare S switches to the expiratory pressure level four seconds after the start of inspiration.

After activation of the flow trigger the RespiCare S remains insensitive for the following times: minimum time for inspiration 300 ms and minimum time for expiration 500 ms, to prevent autonomous triggering of the RespiCare S.

The time of the pressure rise from the expiratory to the inspiratory level is adjustable.

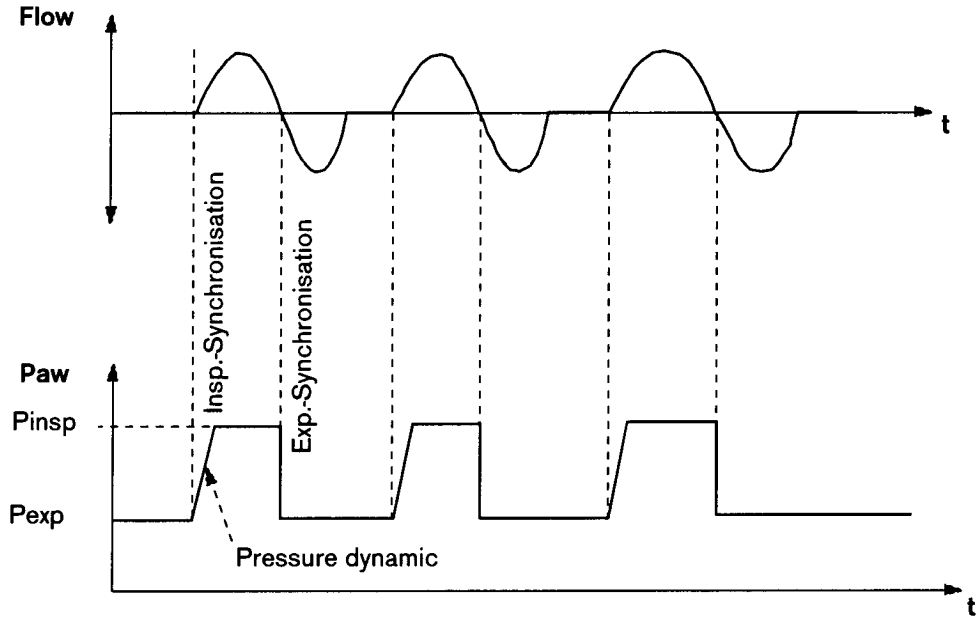

Fig. 11: CPAP/ASB curve diagram

Triggering window, inspiration

The triggering window is produced from 50% of T-low (required) – ΔT-low of the last breath.

ΔT-low = T-low (required) – T-low (actual)

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2.2.3 Leakage flow detection

A leakage flow occurs when respiratory gas escapes by an undetected leak between the patient and the patientís nasal mask.

The flowmeter totalizes the patient flow and the leakage flow. For the inspiration trigger and the expiration trigger always to be activated at the same patient flow, the leakage flow must be known, so that the trigger can compensate for it. The flow signal (ΔP) is translated into l/min and linearized. A filter averages the leakage flow (mean flow).

In standby mode, in the event of a disconnection or a stenosis alarm the mean flow must be reset to zero.

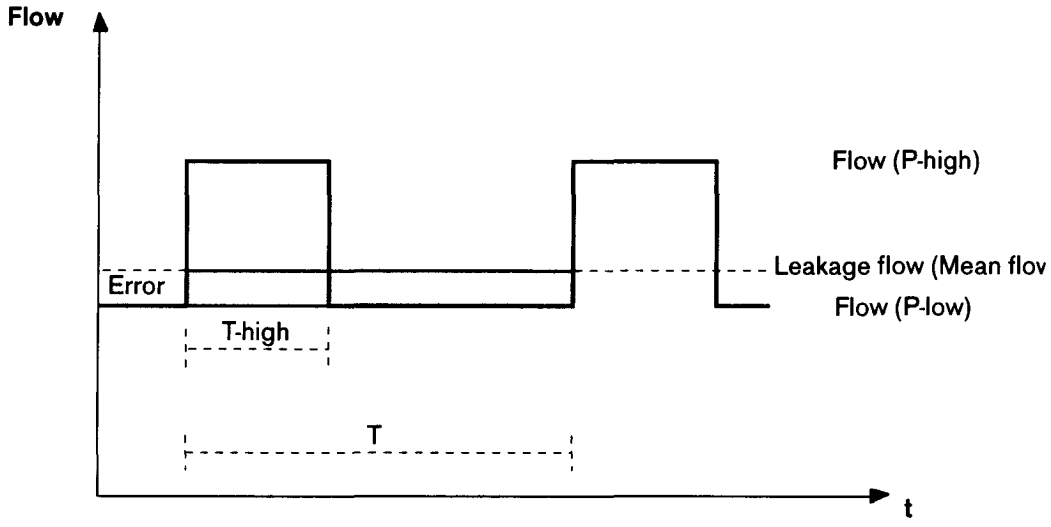

Fig. 12: Leakage flow compensation

The error increases the greater the time T-high is, and the greater the inspiratory leakage flow is. The inspiratory leakage flow is dependent on the mask characteristic and on the inspiratory pressure.

Self-triggering. If the patient flow is too high and an excessive leakage flow is occurring, the RespiCare S may trigger autonomously.

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2.2.4 Triggering

The RespiCare S has five trigger thresholds. The trigger thresholds permit triggering of flow and detection of apnea.

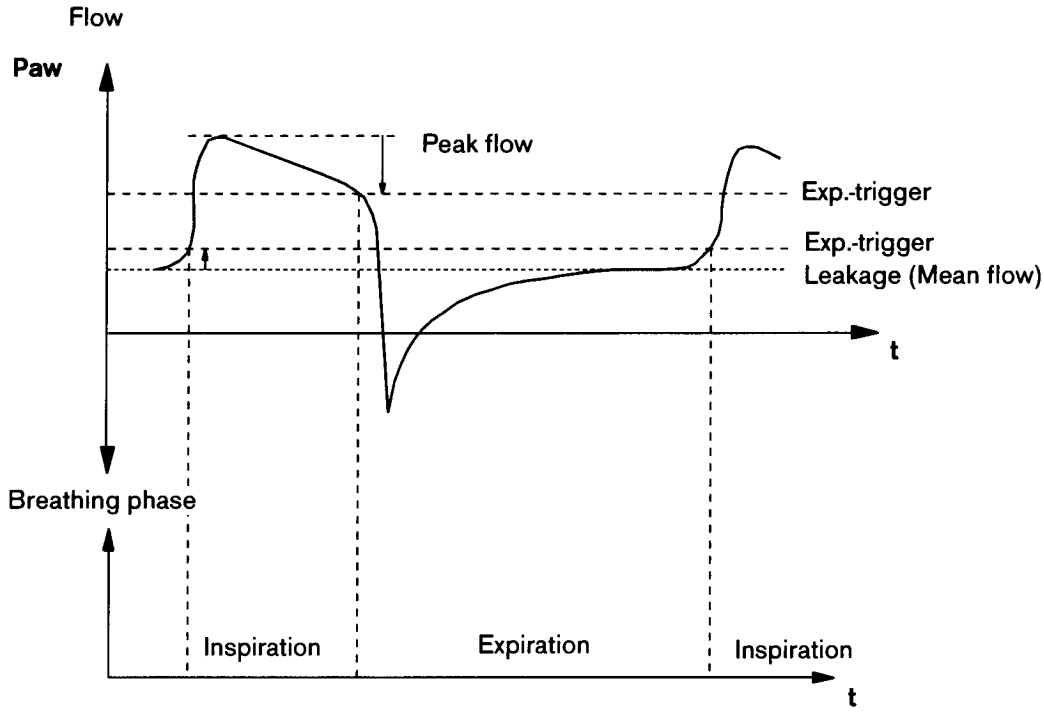

Fig. 13: Trigger thresholds for flow triggering/apnea detection

Trigger thresholds

Trigger threshold	Inspiration trigger (l/min) above leakage (mean flow)	Expiration trigger (l/min) below peak flow
1	13	15
2	20	30
3	30	45
4	40	60
5	50	75

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Inspiration/expiration switchover

Switchover	Conditions	Min. duration	Max. duration
Exp. -> Insp.	Above inspiration trigger level	300 ms	4 s insp.
Insp. -> Exp.	Below expiration trigger level	500 ms	–

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2.3 RespiCare S

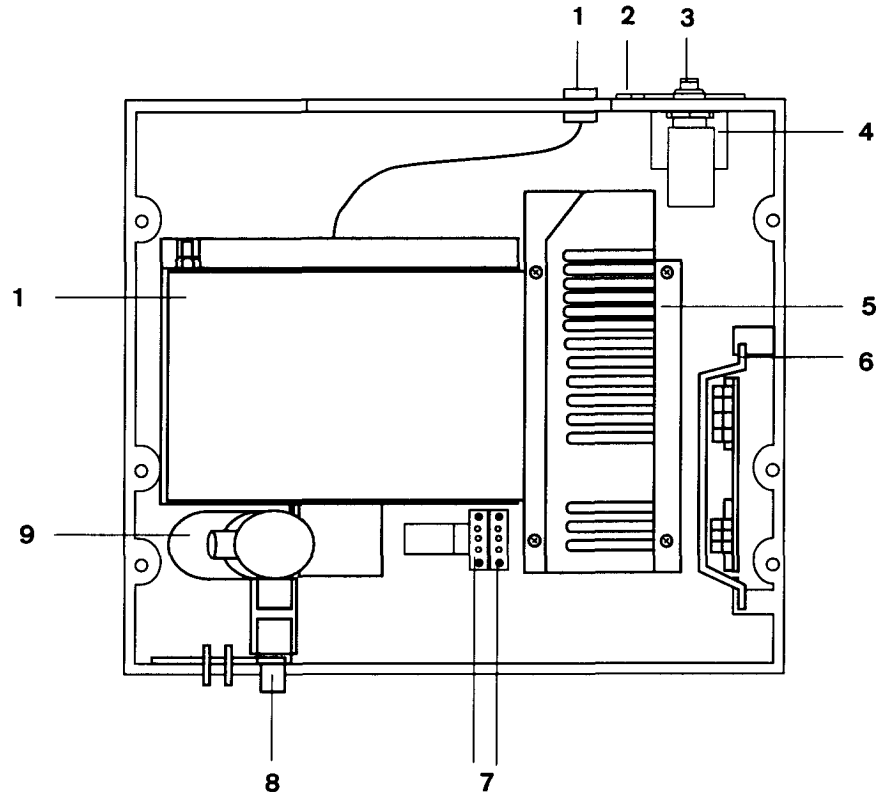

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Fig. 14: Component layout on floor of RespiCare S

Legend

1	Operator control module connecting port
2	Analog port (Paw)
3	Mains switch
4	Mains fuse
5	Power pack
6	Motor actuator
7	Autozero valves
8	Patient connecting port
9	Control valve
10	Blower motor

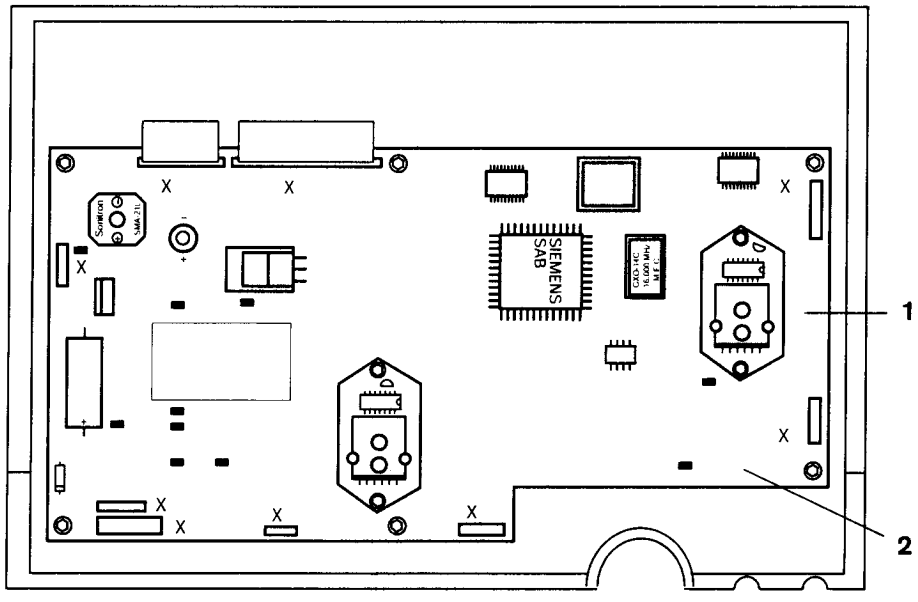

Fig. 15: Component layout in lid of RespiCare S

Legend

1	Control PCB
2	Front console (in the front)

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2.4 Components of the RespiCare S

The RespiCare S comprises the following components:

- On/off switch
- Mains fuse
- Power pack
- Control PCB
- E-vent measuring aperture
- Motor actuator
- Blower motor
- Front console
- Control valve
- Autozero valves
- Operator control module.

2.4.1 On/off switch

The on/off switch switches the mains power on and off respectively at two poles.

2.4.2 Mains fuse

The mains fuse protects against excessive currents in case of fault.

2.4.3 Power pack

The power pack is a switched-mode power supply unit. The mains input voltage is approx. 100 VAC to 240 VAC. The mains output voltages are approx. 13.5 VDC and approx. 24 VDC.

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2.4.4 Control PCB

The control PCB controls and monitors the functions in the RespiCare S. The airway pressure sensor (Paw) and the flow sensor (ΔP) are installed on the control PCB.

The control PCB contains the following components:

- +5 VLOG generator
- Microcontroller
- Quartz
- EPROM
- Latch
- EEPROM
- Driver blocks
- D/A converters
- Airway Pressure sensor (Paw)
- Horn actuator
- Horn
- Autozero valve actuator
- Inside temperature gauge
- Reset generator
- Serial port
- Analog output (Paw).

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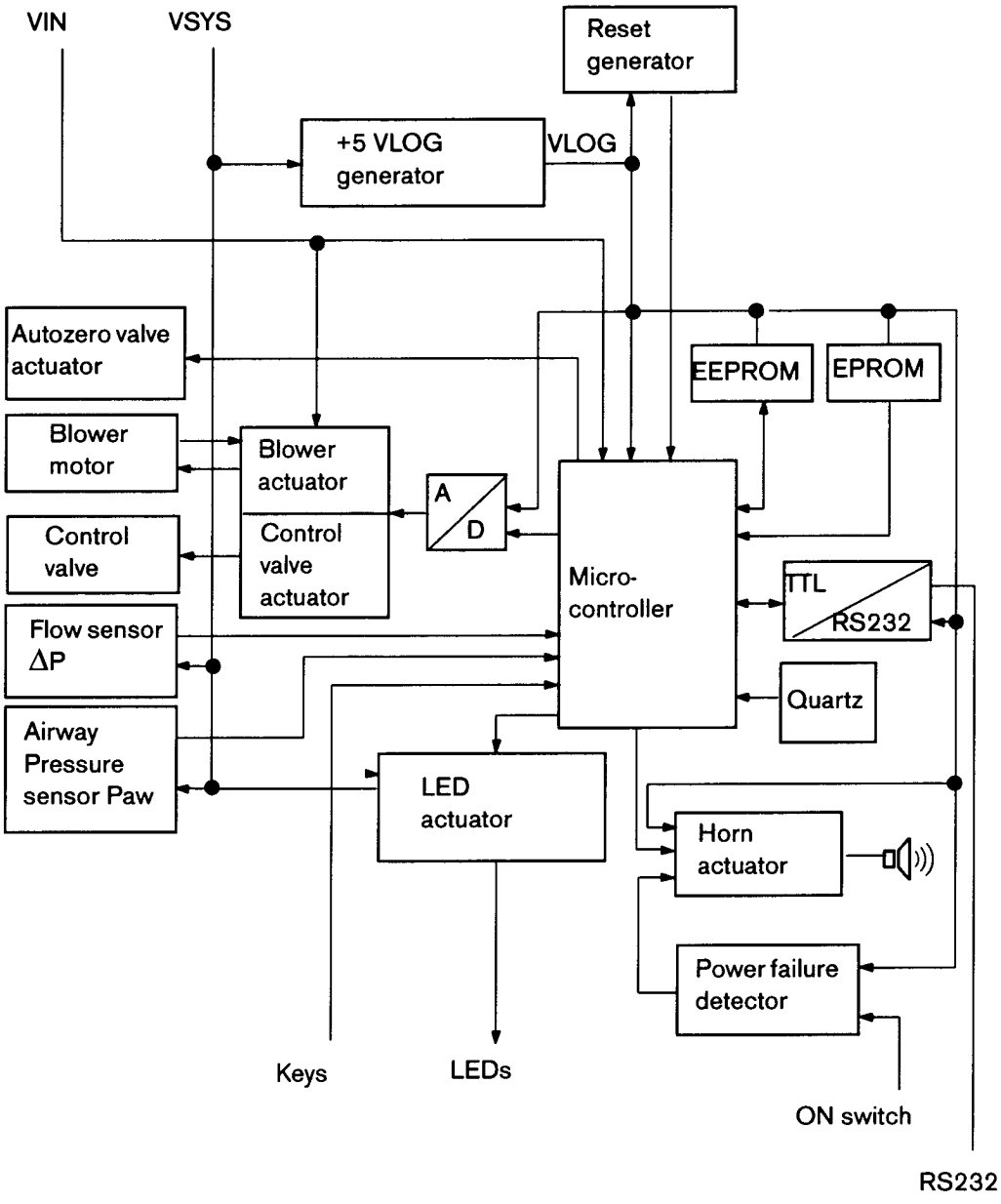

Fig. 16: Block diagram of the control PCB

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+5 VLOG generator

A linear regulator generates the stabilized operating voltage of approx. 5 VDC (VLOG) from the power pack voltage of approx. 13 VDC (VSYS).

Microcontroller

The microcontroller controls and monitors the functions of the RespiCare S.

Quartz

A quartz clocks the microcontroller at a 16 MHz clock frequency.

EPROM

The EPROM contains the software program.

Latch

The data bus data (address for the EPROM) are buffered in the latch.

EEPROM

The EEPROM stores the user settings, calibration data and data of the operating time counter. The EEPROM is serially connected to the microcontroller.

Driver blocks

The actuation signals of the microcontroller are amplified with driver blocks.

D/A converters

D/A converters convert the microcontroller data into analog voltage values.

Airway pressure sensor (Paw)

The airway pressure sensor (Paw) measures the patientís airway pressure. The airway pressure sensor converts the airway pressure into an analog voltage. The microcontroller evaluates the voltage.

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Horn actuator

The microcontroller generates an actuation signal for the horn in case of fault.

When the RespiCare S is on and the VLOG operating voltage falls, the RespiCare S generates a continuous alarm tone.

Horn

The horn is mounted on the control PCB. The horn operating voltage is 5 VLOG.

Autozero valve actuator

The microcontroller generates an actuation signal for the autozero valves every two minutes. The pulse duration is approx. 100 milliseconds.

Inside temperature gauge

A temperature sensor measures the temperature inside the RespiCare S.

If the inside temperature is higher than 65 °C the microcontroller generates an alarm.

Reset generator

The reset generator monitors the 5 VLOG operating voltage. It includes two comparators which monitor the upper and lower tolerance bands of the 5 VLOG operating voltage.

If the voltage moves outside the tolerance, the reset generator generates a reset signal on the microcontroller.

Serial port

The serial port connects the microcontroller to the RS 232 socket.

Analog output (Paw)

A separate pressure curve monitor can be connected to the analog output.

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2.4.5 E-vent measuring aperture

The patientís exhalation flow is measured by reducing the diameter of the E-vent measuring aperture. A flow-dependent differential pressure is produced at measuring points 1 and 2 (see diagram below). This differential pressure is applied to the E-vent measuring aperture. The flow sensor (ΔP) converts the differential pressure into an electronic value and passes the value to the microcontroller for evaluation.

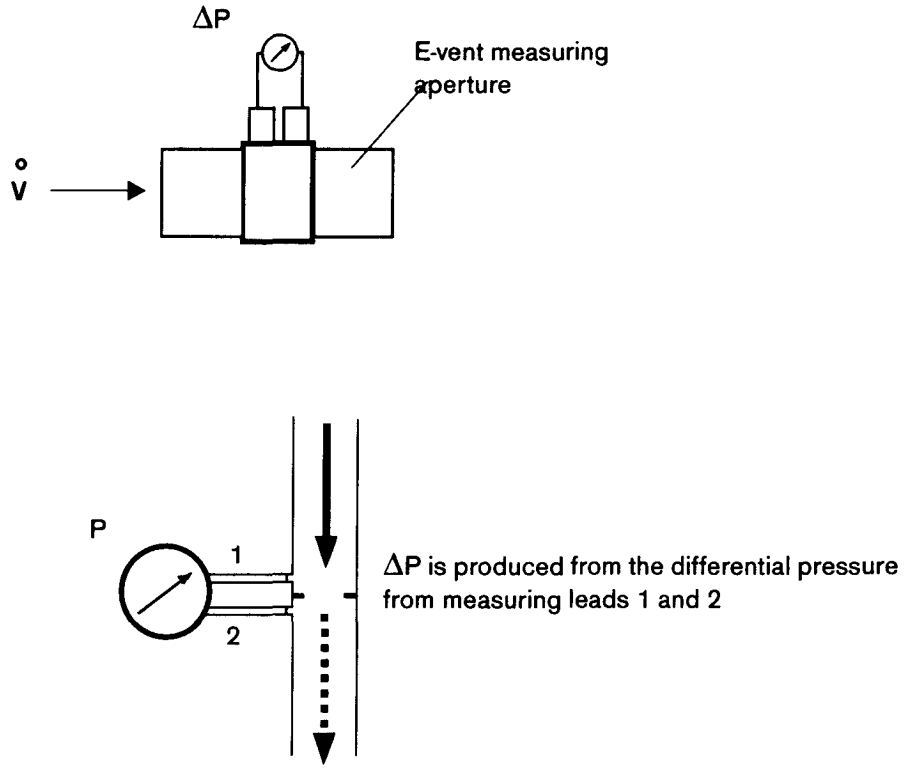

Fig. 17: Flow sensor of the RespiCare S

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2.4.6 Motor actuator

The motor is actuated by a four-quadrant drive. The pre-set value determines the rotational speed of the motor.

2.4.7 Blower motor

The operating voltage of the blower motor is 14 to 28 V.

2.4.8 Front console

The keys and LEDs are mounted on the front console. The pressed keys are read by the microcontroller.

2.4.9 Control valve

The operating voltage of the control valve is 24 V.

2.4.10 Autozero valves

The autozero valves vent the measuring inputs of the airway pressure sensor (Paw) and the flow sensor (ΔP) every two minutes into the atmosphere.

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2.5 Operator control module

The operator control module is adaptable for the RespiCare S by means of a magnetic fixture. The operator control module includes the input unit and the LC display. The mode and patient setting parameters are set with the operator control module in the RespiCare S. The display represents the patient settings with 4x20 characters.

The backlighting is activated when one of the three keys on the operator control module is pressed, and goes out automatically two minutes after the last press.

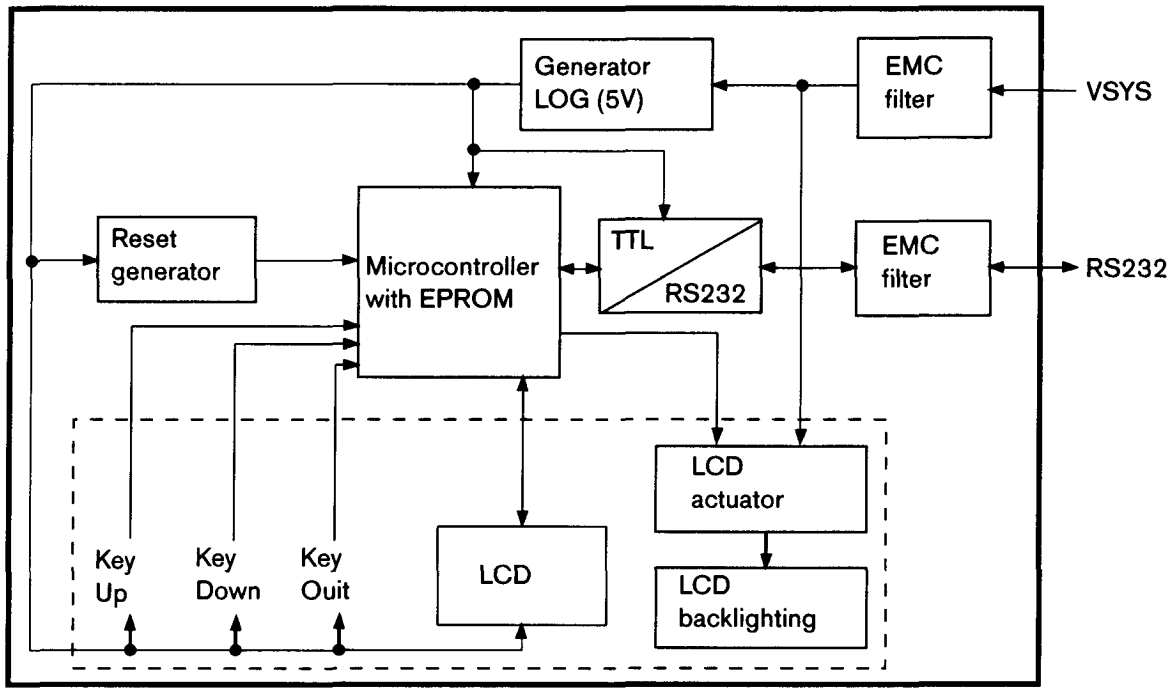

Fig. 18: Block diagram of the operator control module

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2.6 Ports

The RespiCare S has two ports.

2.6.1 Bidirectional port

A bidirectional RS 232 port permits operation of the operator control module.

2.6.2 External power connection

An external power connection allows the RespiCare S to be operated with an external voltage of 100 VAC to 240 VAC, or with a DC/AC converter (accessory).

2.7 Self-test

After power-up the RespiCare S carries out a self-test lasting approximately 5 seconds.

The following functions are tested in the self-test:

- All LEDs and displays
- Display of software version when operator control module in use
- RAM/ROM
- EPROM checksum
- Horn activation
- Voltage monitoring.

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2.8 Alarms

2.8.1 Power failure

In the event of power failure the acoustic alarm sounds. An internal power source supplies the horn with operating voltage. The acoustic alarm sounds for 120 seconds.

2.8.2 Disconnection alarm / Stenosis alarm

The disconnection alarm or stenosis alarm can be deactivated with the operator control module.

The disconnection alarm/stenosis alarm is conditioned by a pressure comparison between the pressure Paw (required) and the pressure Paw (actual). If the pressure Paw does not reach the required value, a counter is incremented. If the counter reading exceeded, an alarm is triggered.

Criterion

a) Paw (required) > 10 mbar: Paw (actual) < Paw (required) – 5 mbar

b) Paw (required) ≤ 10 mbar: Paw (actual) < 50% Paw (required)

2.8.3 Device fault

In the event of a device fault the RespiCare S switches off the blower motor. The acoustic alarm sounds.

In the event of blower motor failure, continued spontaneous breathing of the patient is possible.

2.8.4 Inside temperature

If the inside temperature within the RespiCare S is higher than 65 °C the RespiCare S generates the technical fault "Device Malfunction" on the display of the operator control module.

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2.9 Counters

2.9.1 Total operating time

The total counter (Tot) is displayed on the operator control module. The total counter (Tot) is an absolute time counter which represents the total operating time.

2.9.2 Patient usage

The patient usage counter (Pat) is displayed on the operator control module. The blower motor running time is registered.

2.9.3 Service interval

The service interval counter (Service) is displayed on the operator control module. The Service LED (screwdriver) on the RespiCare S lights up when a service is due.

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3 RespiCare SC

The RespiCare SC is a nasal respiration therapy unit. The RespiCare SC is for patients with spontaneous breathing capability requiring temporary assistance in breathing.

The RespiCare SC allows spontaneous breathing with a continuous positive airway pressure (CPAP), spontaneous breathing with a continuous positive airway pressure and synchronized assistance (CPAP/ASB), pressure controlled ventilation (PCV), spontaneous breathing with controlled changeover between two pressure levels (PCV +), and a pressure controlled ventilation with synchronized inspiratory phase (PCV S).

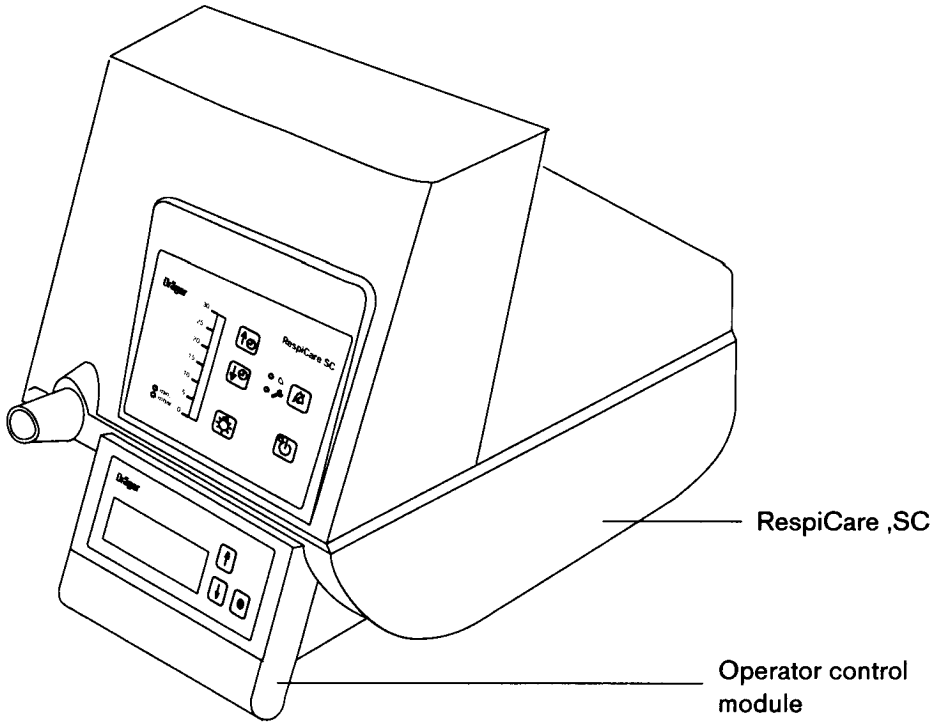

Fig. 19: View of the RespiCare SC

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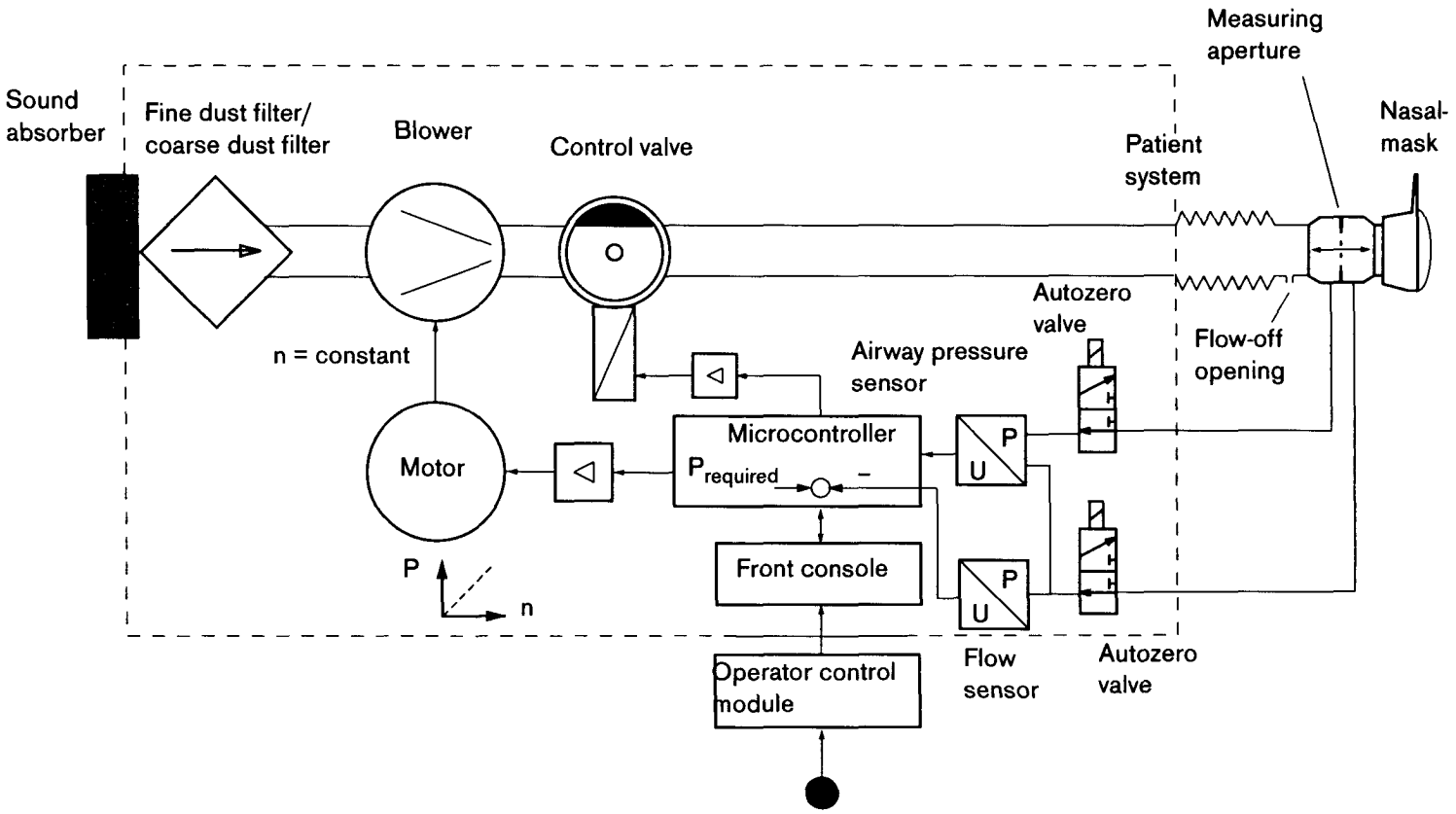

Fig. 20: Function diagram, RespiCare SC

3.1 Mode of functioning of the RespiCare SC

The inducted ambient air is passed through a fine dust filter/coarse dust filter and is compressed according to the pre-set ventilation pressure.

The blower delivers a patient flow of at least 60 l/min at an airway pressure of 30 mbar.

The upper pressure level set for the patient limits the rotational speed of the blower.

A control valve controls the pressure levels. The microcontroller controls the opening and closing of the control valve dependent on the airway pressure (Paw). The steepness of the pressure rise can be varied with the actuation speed of the control valve.

A bidirectional flow detector measures the patient flow and detects triggering of patient respiration.

The airway pressure sensor measures the airway pressure (Paw). The airway pressure is visually displayed on a strip display.

A flow-off opening in the measuring aperture permits gas exchange from the patient system.

In the event of blower motor failure, continued spontaneous breathing of the patient is possible.

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3.2 Operating modes of the RespiCare SC

The operating modes of the RespiCare SC are CPAP, CPAP/ASB, PCV, PCV (+) and PCV (S).

3.2.1 CPAP

CPAP is a spontaneous breathing with a positive airway pressure.

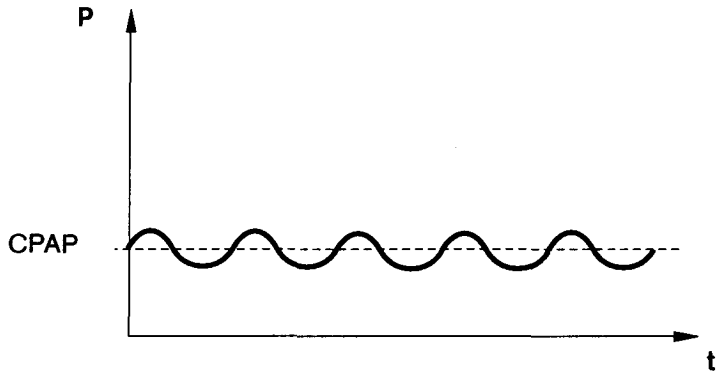

Fig. 21: CPAP curve diagram

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3.2.2 CPAP/ASB

CPAP/ASB is an assisted spontaneous breathing with adjustable pressure support.

The inspiratory or expiratory flow is triggered by the pre-set inspiration or expiration pressure, as appropriate.

If the expiratory flow is not triggered, the RespiCare SC switches to the expiratory pressure level four seconds after the start of inspiration.

After activation of the flow trigger the RespiCare SC remains insensitive for the following times: minimum time for inspiration 300 ms and minimum time for expiration 500 ms, to prevent autonomous triggering of the RespiCare SC.

The time of the pressure rise from the expiratory to the inspiratory level is adjustable.

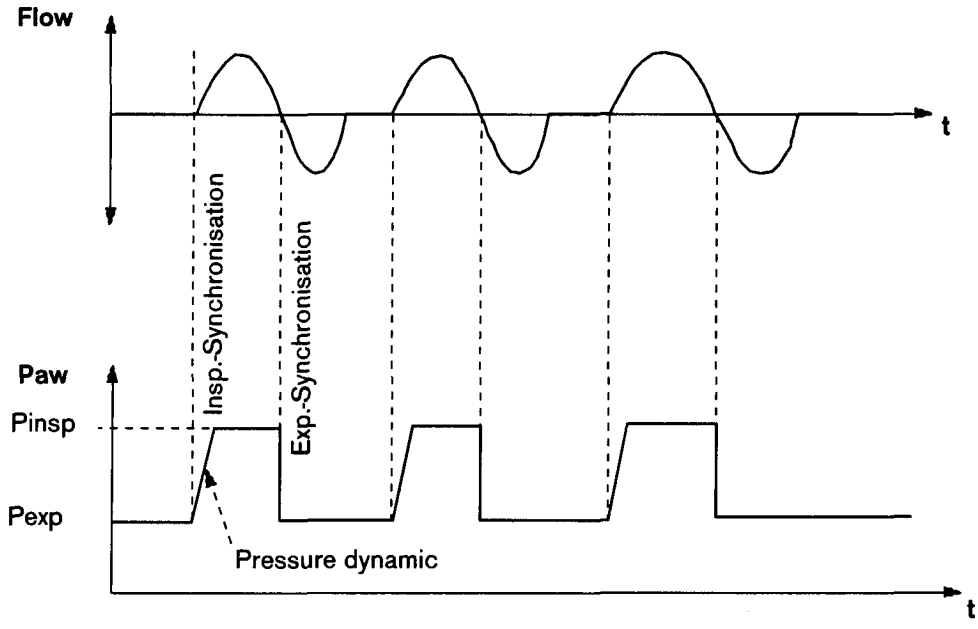

Fig. 22: CPAP/ASB curve diagram

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3.2.3 PCV

PCV is a controlled breathing at constant rate and constant I/E ratio at two different pressure levels.

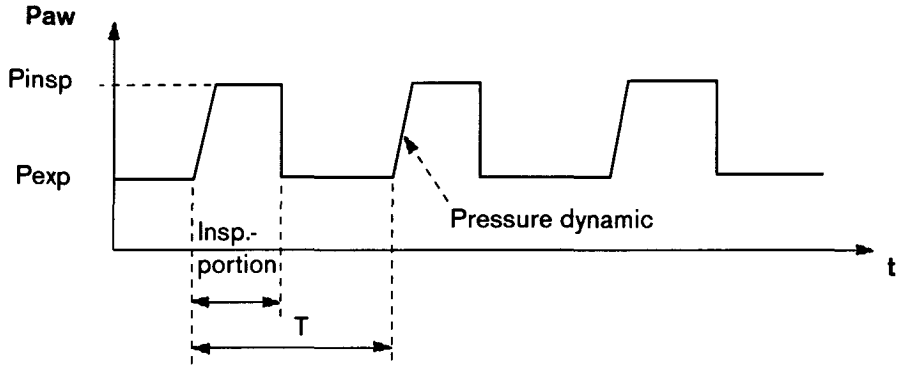

Fig. 23: PCV curve diagram

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3.2.4 PCV (+)

PCV (+) is a spontaneous breathing at two different pressure levels with independently adjustable time ranges.

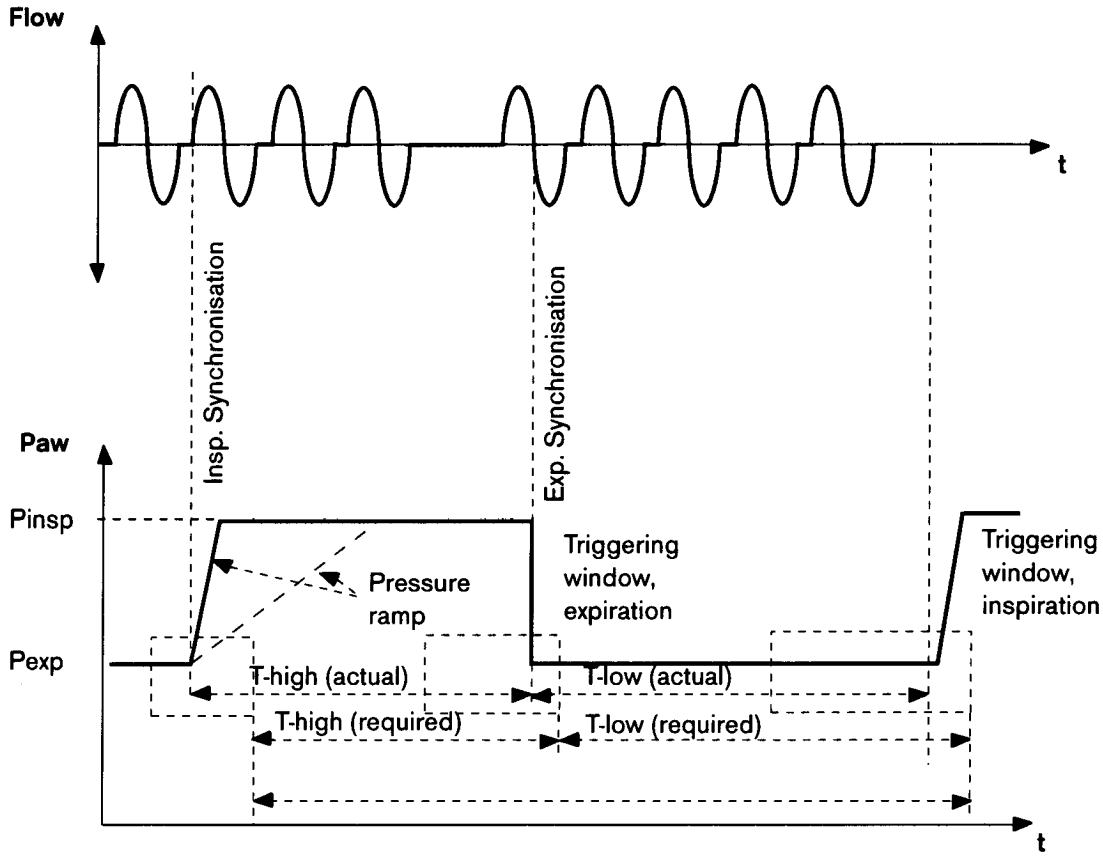

Fig. 24: PCV (+) curve diagram

On a variable time base, the RespiCare SC switches between the high and low pressure levels. The switchover during inspiration is synchronous to the positive edge, and in expiration is synchronous to the negative edge. The pre-set times, resulting from the rate and the I/E ratio, remain constant.

In PCV (+) mode the pressure ramp depends on the pre-set time T-high. The pre-set time T-high divides the number of stages into equal time segments such that, at the highest setting, the upper pressure level is reached after 50% of T-high.

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Triggering window, inspiration

The triggering window is produced from 50% of T-low (required) – ΔT-low of the last breath.

ΔT-low = T-low (required) – T-low (actual)

Triggering window, expiration

The triggering window is produced from 50% of T-high (required) – ΔT-high of the last breath.

ΔT-high = T-high (required) – T-high (actual)

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3.2.5 Leakage flow detection

A leakage flow occurs when respiratory gas escapes by an undetected leak between the patient and the patientís nasal mask.

The flowmeter totalizes the patient flow and the leakage flow. For the inspiration trigger and the expiration trigger always to be activated at the same patient flow, the leakage flow must be known, so that the trigger can compensate for it. The flow signal (ΔP) is translated into l/min and linearized. A filter averages the leakage flow (mean flow).

In standby mode, in the event of a disconnection or a stenosis alarm the mean flow must be reset to zero.

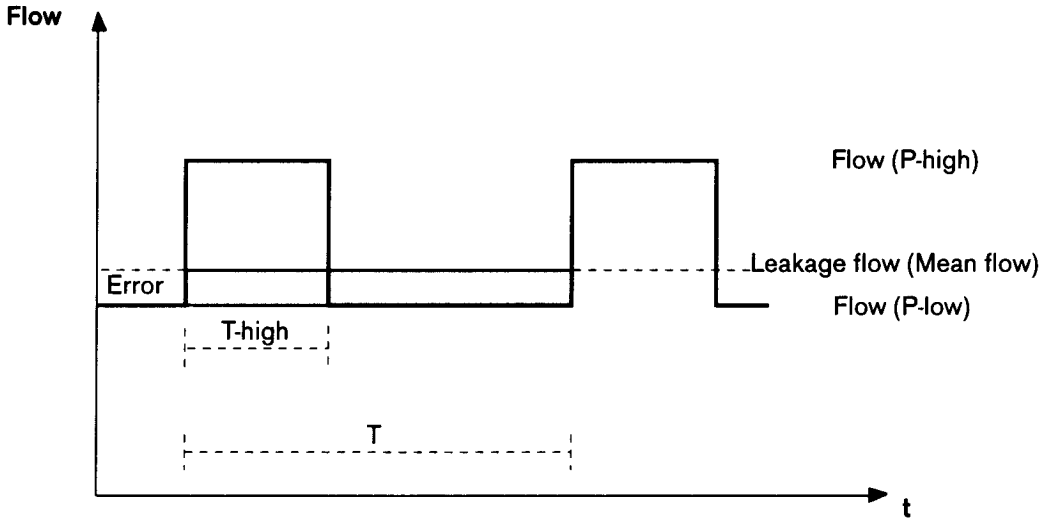

Fig. 25: Leakage flow compensation

The error increases the greater the time T-high is, and the greater the inspiratory leakage flow is. The inspiratory leakage flow is dependent on the mask characteristic and on the inspiratory pressure.

Self-triggering. If the patient flow is too high and an excessive leakage flow is occurring, the RespiCare SC may trigger autonomously.

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3.2.6 Triggering

The RespiCare SC has five trigger thresholds. The trigger thresholds permit triggering of flow and detection of apnea.

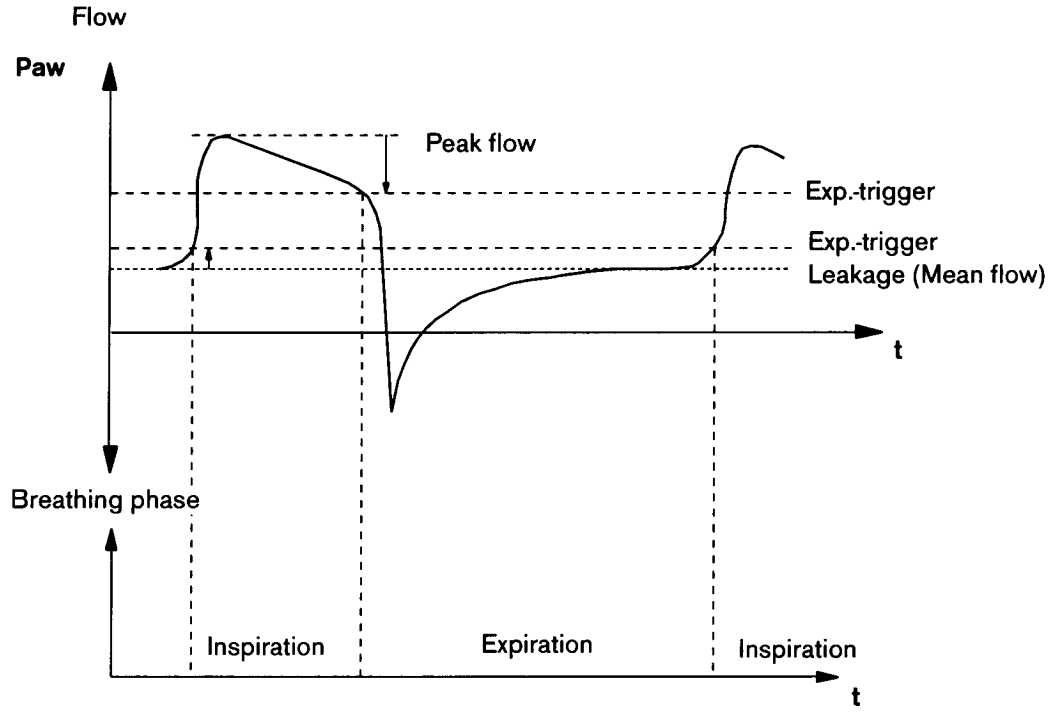

Fig. 26: Trigger thresholds for flow triggering/apnea detection

Trigger thresholds

Trigger threshold	Inspiration trigger (l/min) above leakage (mean flow)	Expiration trigger (l/min) below peak flow
1	13	15
2	20	30
3	30	45
4	40	60
5	50	75

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Inspiration/expiration switchover

Switchover	Conditions	Min. duration	Max. duration
Exp. -> Insp.	Above inspiration trigger level	300 ms	4 s insp.
Insp. -> Exp.	Below expiration trigger level	500 ms	–

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3.3 RespiCare SC

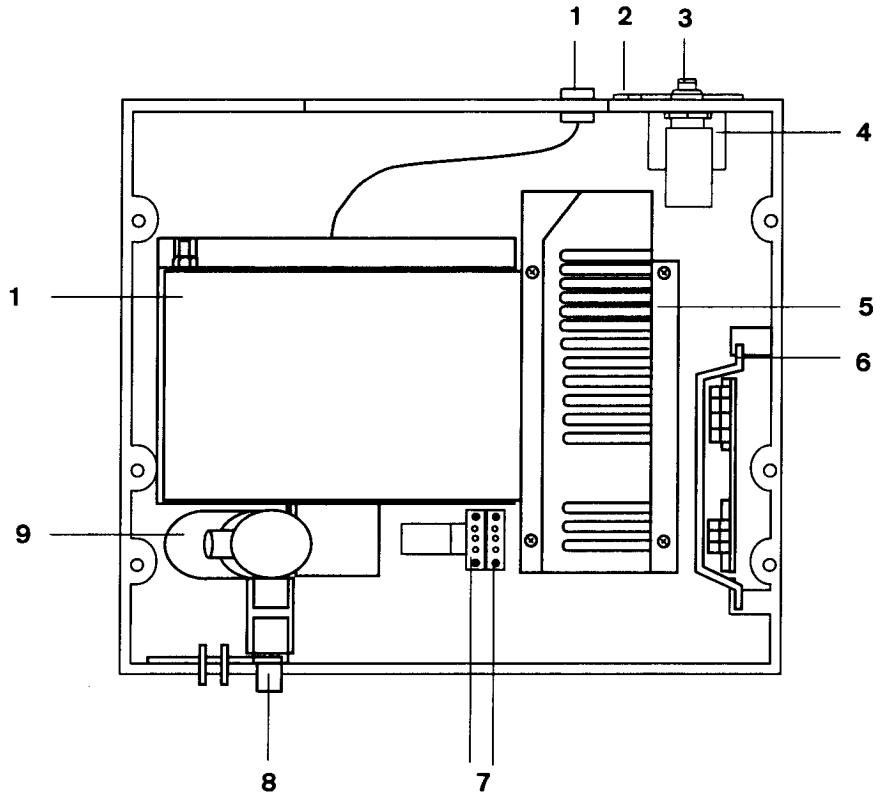

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Fig. 27: Component layout on floor of RespiCare SC

Legend

1	Operator control module connecting port
2	Analog port (Paw)
3	Mains switch
4	Mains fuse
5	Power pack
6	Motor actuator
7	Autozero valves
8	Patient connecting port
9	Control valve
10	Blower motor

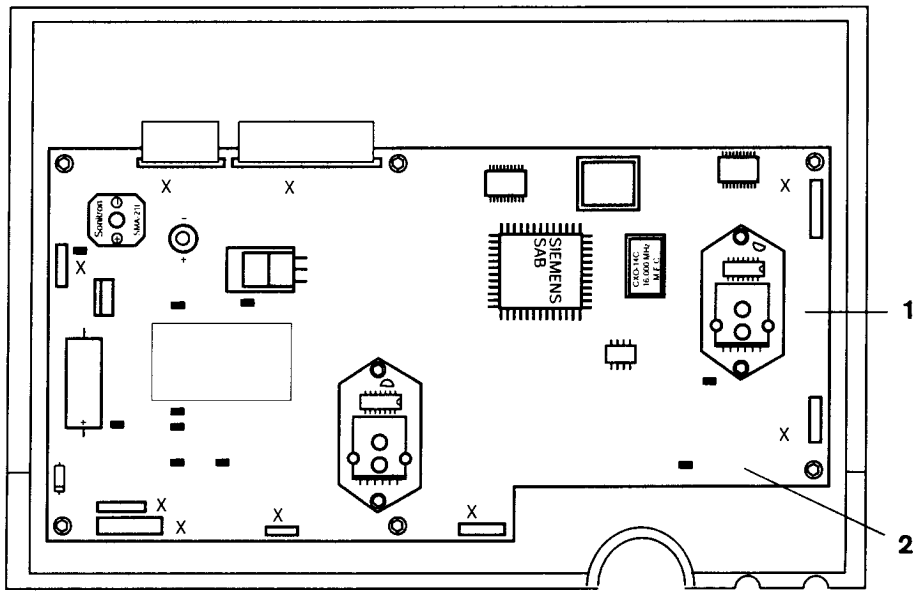

Fig. 28: Component layout in lid of RespiCare SC

Legend

1	Control PCB
2	Front console (in the front)

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3.4 Components of the RespiCare SC

The RespiCare SC comprises the following components:

- On/off switch
- Mains fuse
- Power pack
- Control PCB
- E-vent measuring aperture
- Motor actuator
- Blower motor
- Front console
- Control valve
- Autozero valves
- Operator control module.

3.4.1 On/off switch

The on/off switch switches the mains power on and off respectively at two poles.

3.4.2 Mains fuse

The mains fuse protects against excessive currents in case of fault.

3.4.3 Power pack

The power pack is a switched-mode power supply unit. The mains input voltage is approx. 100 VAC to 240 VAC. The mains output voltages are approx. 13.5 VDC and approx. 24 VDC.

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3.4.4 Control PCB

The control PCB controls and monitors the functions in the RespiCare SC. The airway pressure sensor (Paw) and the flow sensor (ΔP) are installed on the control PCB.

The control PCB contains the following components:

- +5 VLOG generator
- Microcontroller
- Quartz
- EPROM
- Latch
- EEPROM
- Driver blocks
- D/A converters
- Airway pressure sensor (Paw)
- Horn actuator
- Horn
- Autozero valve actuator
- Inside temperature gauge
- Reset generator
- Serial port
- Analog output (Paw).

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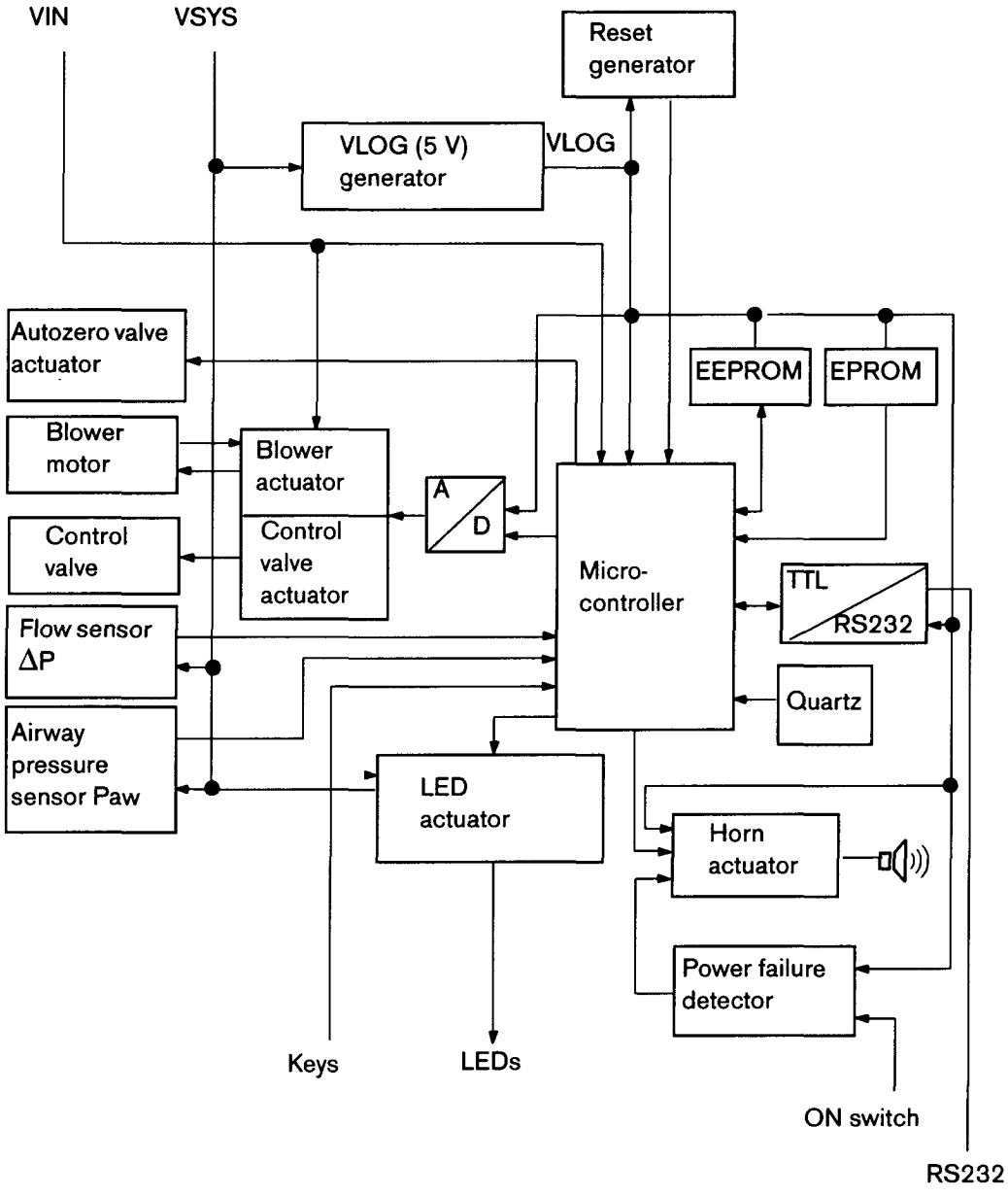

Fig. 29: Block diagram of the control PCB

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5 VLOG generator

A linear regulator generates the stabilized operating voltage of approx. 5 VDC (VLOG) from the power pack voltage of approx. 13 VDC (VSYS).

Microcontroller

The microcontroller controls and monitors the functions of the RespiCare SC.

Quartz

A quartz clocks the microcontroller at a 16 MHz clock frequency.

EPROM

The EPROM contains the software program.

Latch

The data bus data (address for the EPROM) are buffered in the latch.

EEPROM

The EEPROM stores the user settings, calibration data and data of the operating time counter. The EEPROM is serially connected to the microcontroller.

Driver blocks

The actuation signals of the microcontroller are amplified with driver blocks.

D/A converters

D/A converters convert the microcontroller data into analog voltage values.

Airway pressure sensor (Paw)

The airway pressure sensor (Paw) measures the patientís airway pressure. The airway pressure sensor (Paw) converts the airway pressure into an analog voltage. The microcontroller evaluates the voltage.

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Horn actuator

The microcontroller generates an actuation signal for the horn in case of fault.

When the RespiCare SC is on and the VLOG operating voltage falls, the RespiCare SC generates a continuous alarm tone.

Horn

The horn is mounted on the control PCB. The horn operating voltage is 5 VLOG.

Autozero valve actuator

The microcontroller generates an actuation signal for the autozero valves every two minutes. The pulse duration is approx. 100 milliseconds.

Inside temperature gauge

A temperature sensor measures the temperature inside the RespiCare SC.

If the inside temperature is higher than 65 °C the microcontroller generates an alarm.

Reset generator

The reset generator monitors the 5 VLOG operating voltage. It includes two comparators which monitor the upper and lower tolerance bands of the 5 VLOG operating voltage.

If the voltage moves outside the tolerance, the reset generator generates a reset signal on the microcontroller.

Serial port

The serial port connects the microcontroller to the RS 232 socket.

Analog output (Paw)

A separate pressure curve monitor can be connected to the analog output.

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3.4.5 E-vent measuring aperture

The patientís exhalation flow is measured by reducing the diameter of the E-vent measuring aperture. A flow-dependent differential pressure is produced at measuring points 1 and 2 (see diagram below). This differential pressure is applied to the E-vent measuring aperture. The flow sensor (ΔP) converts the differential pressure into an electronic value and passes the value to the microcontroller for evaluation.

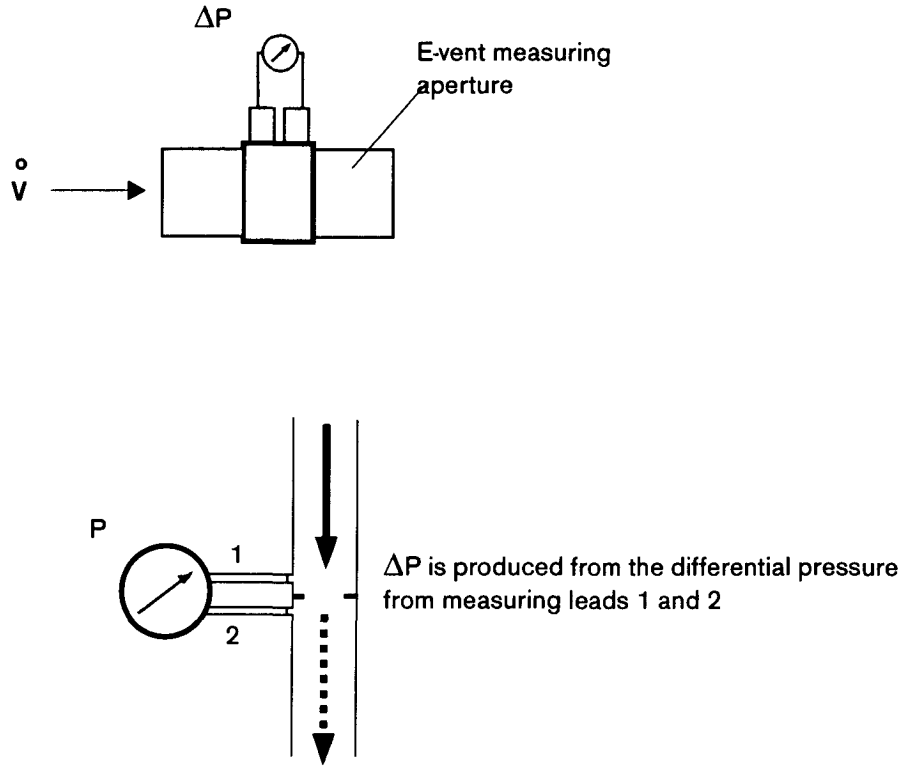

Fig. 30: Flow sensor of the RespiCare SC

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3.4.6 Motor actuator

The motor is actuated by a four-quadrant drive. The pre-set value determines the rotational speed of the motor.

3.4.7 Blower motor

The operating voltage of the blower motor is 14 to 28 V.

3.4.8 Front console

The keys and LEDs are mounted on the front console. The pressed keys are read by the microcontroller.

3.4.9 Control valve

The operating voltage of the control valve is 24 V.

3.4.10 Autozero valves

The autozero valves vent the measuring inputs of the airway pressure sensor (Paw) and the flow sensor (ΔP) every two minutes into the atmosphere.

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3.5 Operator control module

The operator control module is adaptable for the RespiCare SC by means of a magnetic fixture. The operator control module includes the input unit and the LC display. The mode and patient setting parameters are set with the operator control module in the RespiCare SC. The display represents the patient settings with 4x20 characters.

The backlighting is activated when one of the three keys on the operator control module is pressed, and goes out automatically two minutes after the last press.

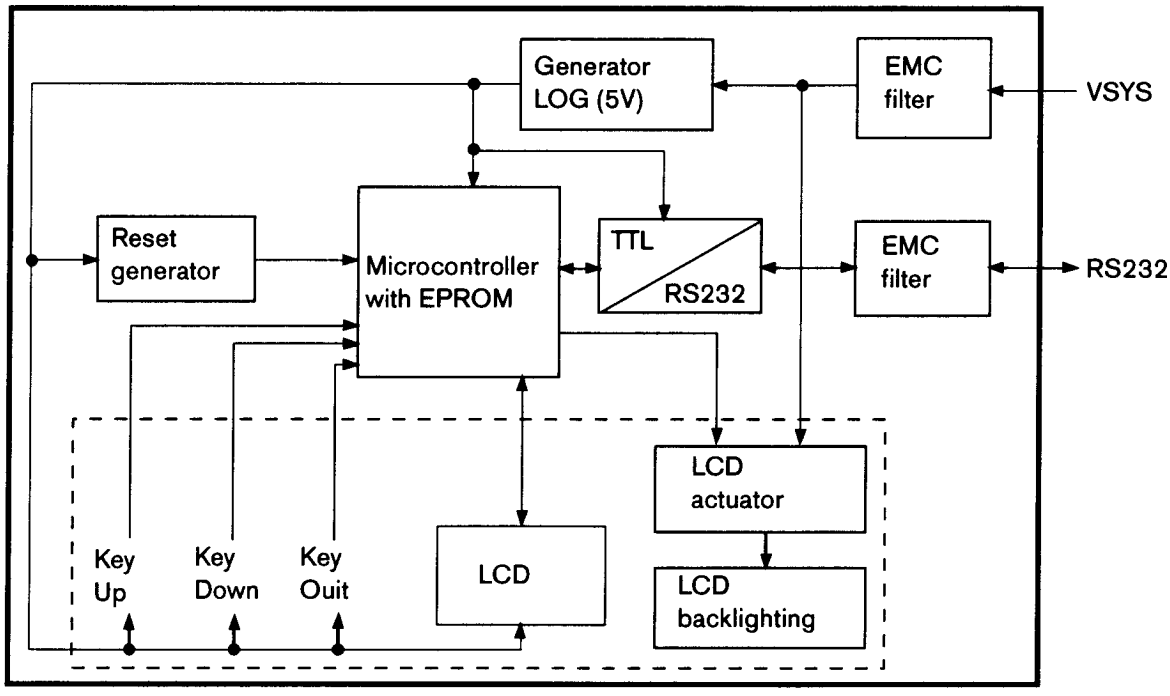

Fig. 31: Block diagram of the operator control module

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3.6 Ports

The RespiCare SC has two ports.

3.6.1 Bidirectional port

A bidirectional RS 232 port permits operation of the operator control module.

3.6.2 External power connection

An external power connection allows the RespiCare SC to be operated with an external voltage of 100 VAC to 240 VAC, or with a DC/AC converter (accessory).

3.7 Self-test

After power-up the RespiCare SC carries out a self-test lasting approximately 5 seconds.

The following functions are tested in the self-test:

- All LEDs and displays
- Display of software version when operator control module in use
- RAM/ROM
- EPROM checksum
- Horn activation
- Voltage monitoring.

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3.8 Alarms

3.8.1 Power failure

In the event of power failure the acoustic alarm sounds. An internal power source supplies the horn with operating voltage. The acoustic alarm sounds for 120 seconds.

3.8.2 Disconnection alarm / Stenosis alarm

The disconnection alarm or stenosis alarm can be deactivated with the operator control module.

The disconnection alarm/stenosis alarm is conditioned by a pressure comparison between the pressure Paw (required) and the pressure Paw (actual). If the pressure Paw does not reach the required value, a counter is incremented. If the counter reading exceeded, an alarm is triggered.

Criterion

a) Paw (required) > 10 mbar: Paw (actual) < Paw (required) – 5 mbar

b) Paw (required) ≤ 10 mbar: Paw (actual) < 50% Paw (required)

3.8.3 Device fault

In the event of a device fault the RespiCare SC switches off the blower motor. The acoustic alarm sounds.

In the event of blower motor failure, continued spontaneous breathing of the patient is possible.

3.8.4 Inside temperature

If the inside temperature within the RespiCare SC is higher than 65 °C the RespiCare SC generates the technical fault "Device Malfunction" on the display of the operator control module.

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3.9 Counters

3.9.1 Total operating time

The total counter (Tot) is displayed on the operator control module. The total counter (Tot) is an absolute time counter which represents the total operating time.

3.9.2 Patient usage

The patient usage counter (Pat) is displayed on the operator control module. The motor blower running time is registered.

3.9.3 Service interval

The service interval counter (Service) is displayed on the operator control module. The Service LED (screwdriver) on the RespiCare SC lights up when a service is due.

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Test List

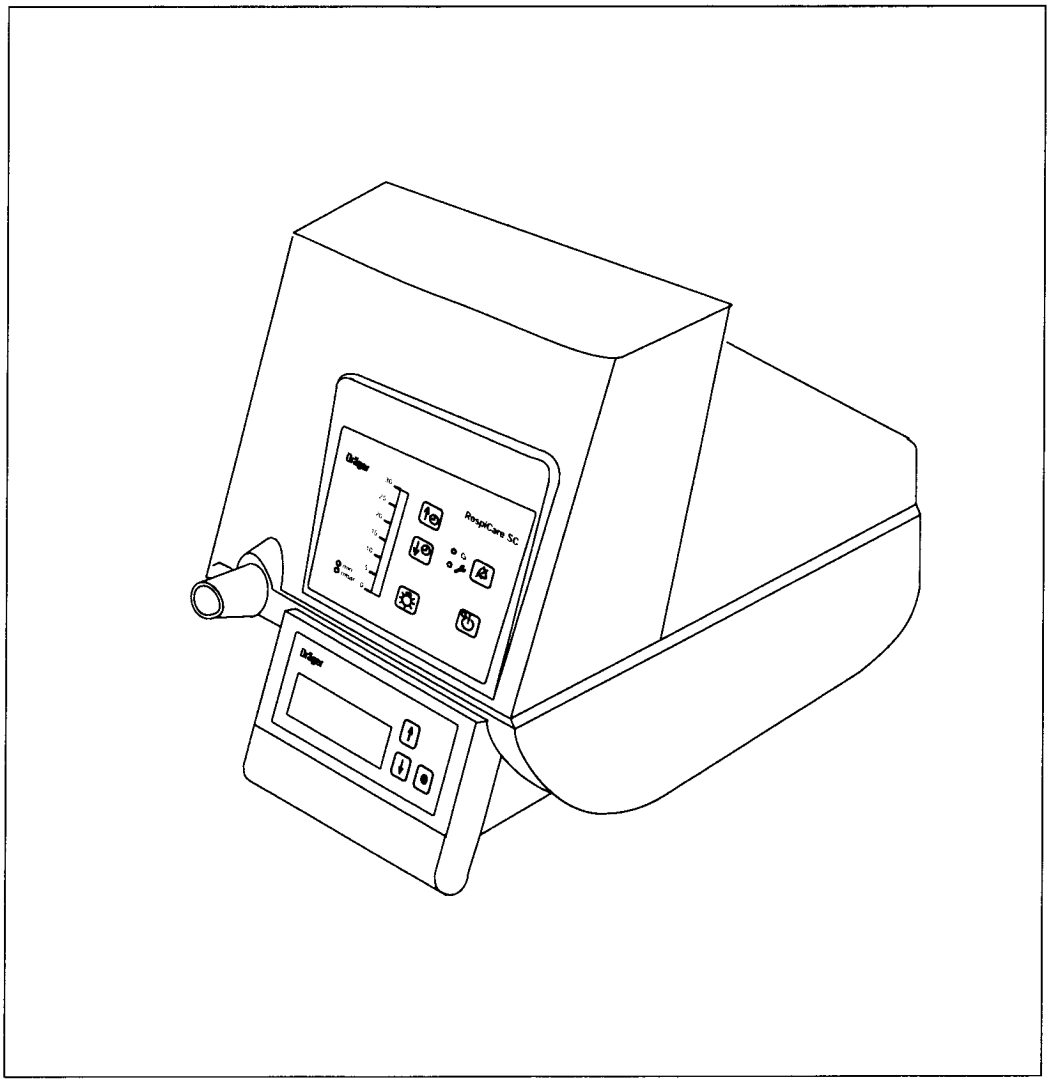
RespiCare, Software 1.n

Serial no.: _____

Installation site: _____

Folder no.:
5665.200

Revision:
04/97



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This Test List does not replace inspections and servicing by Dräger Medical AG & Co. KGaA

1 Test Equipment

Test hoses

E-Vent test outlet

Ventilation hose

Breathing bag

2 Accompanying Documents

Instructions for Use ☐

3 General Appearance

Basic unit

Operator control module

Test hoses including E-Vent test outlet

Patient hose system

Oxygen adapter

Nasal mask

DC/AC converter (accessory)

Cable for analog output (Paw). ☐

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4 Functions Tests

4.1 Power Failure Alarm Test

- Assemble the RespiCare ready for operation (operator control module, test hoses incl. E-Vent test outlet, ventilation hose, and breathing bag).
- Disconnect the mains plug of the RespiCare from the mains socket-outlet.
- Switch on the RespiCare using the ON/OFF switch (1) (located on the rear panel).

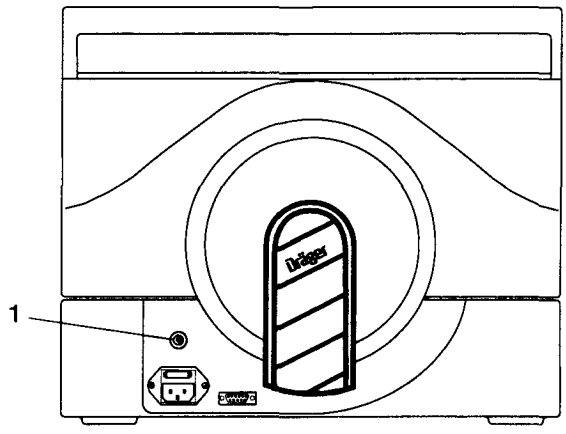

Abb. 1: Rear view of the RespiCare

The continuous alarm tone sounds.

- Switch off the RespiCare using the ON/OFF switch.

The continuous alarm tone stops.

- Connect the mains plug of the RespiCare to the mains socket-outlet.

4.2 Power-On Test

- Switch on the RespiCare.

The RespiCare runs a self-test. The pixels on the display of the operator control module and all LEDs of the RespiCare basic unit light up. A short alarm tone sounds.

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4.3 RespiCare N Function Test

- Switch on the RespiCare N.
- Using the operator control module, adjust a pressure (Paw) of 10 mbar.

The breathing bag should inflate within 5 seconds. ☐

4.4 RespiCare S Function Test

- Switch on the RespiCare S.
- Select the CPAP mode.
- Adjust a CPAP pressure of 5 mbar.
- Select the CPAP/ASB mode.
- Adjust an inspiratory pressure (Pinsp) of 15 mbar.
- Adjust an ASB ramp (Ramp) of 0.5 s.
- Trigger the RespiCare S by slightly compressing the breathing bag.

The RespiCare S builds up the ASB pressure and the breathing bag inflates. ☐

4.5 RespiCare SC Function Test

- Switch on the RespiCare SC.
- Select the PCV(+) mode.
- Adjust the following values:
  - upper pressure level (P-high) to 20 mbar
  - lower pressure level (P-low) to 10 mbar
  - time (Thigh) to 4 seconds
  - time (Tlow) to 2 seconds
  - trigger.I to 2 of 5
  - trigger.E to 2 of 5
  - ramp to 20%
- Trigger the RespiCare SC by slightly compressing the breathing bag.

The breathing bag inflates. The time-controlled change between pressure leves is synchronized with the patient's spontaneous breathing. ☐

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4.6 Displaying/Recording the Operating Hours

- Switch off the RespiCare.
- Switch on the RespiCare and press and hold the standby key for about 4 seconds until the operator control module displays the following message:

CSM - Customer Service Mode

- Stop pressing the standby key.

The operator control module displays the following message:

Adjust language
<– – 001 + –>

- Select the operating hours meters (Test 003) by pressing the arrow-up key twice.

The operator control module displays the following message:

Operation hours
<– – 003 + –>

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- Press the confirm-key (dot key).
- Record the operating hours of the RespiCare in the following fields.

Total (Tot)

Patient (Pat)

Service

- Switch off the RespiCare.

5 Assemble the RespiCare ready for operation.

Date: _____ Name: _____

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1 Replacing the Fine Dust Filter/Coarse Dust Filter

1.1 General Information about the Fine Dust Filter/ Coarse Dust Filter

1.1.1 Fine Dust Filter

- The fine dust filter must be replaced with a new one at the following intervals:

– every six months

– after 500 hours of application
(use the Instructions for Use to find out about the hours of application)

Risk of malfunction. Damaged fine dust filter may impair the function of the RespiCare. **Always replace a damaged fine dust filter with a new one.**

1.1.2 Coarse Dust Filter

- The coarse dust filter must be cleaned every three weeks.
- The coarse dust filter must be replaced with a new one after six months.

Risk of malfunction. Damaged fine dust filter may impair the function of the RespiCare. **Always replace a damaged fine dust filter with a new one.**

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1.2 Removing/Replacing the Fine Dust Filter/Coarse Dust Filter

- Disconnect the mains plug (1) from the socket of the RespiCare.
- Remove the silencer (2) (located on the rear panel of the RespiCare) by pulling it out.

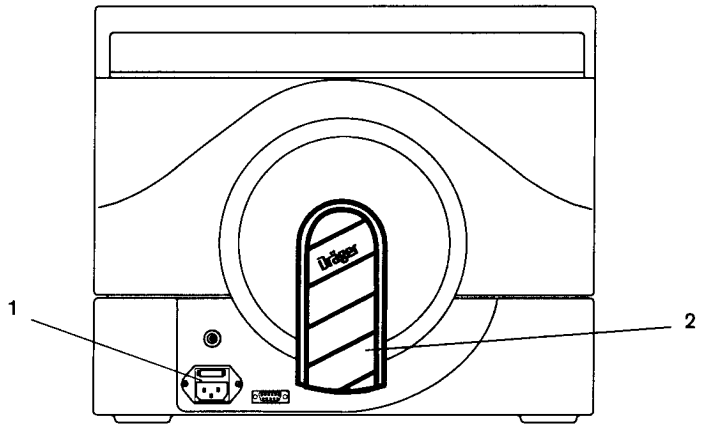

Fig. 1: Rear view of the RespiCare, removing the silencer

- Turn the mount (3) of the fine dust filter/coarse dust filter anti-clockwise and place the mount aside.

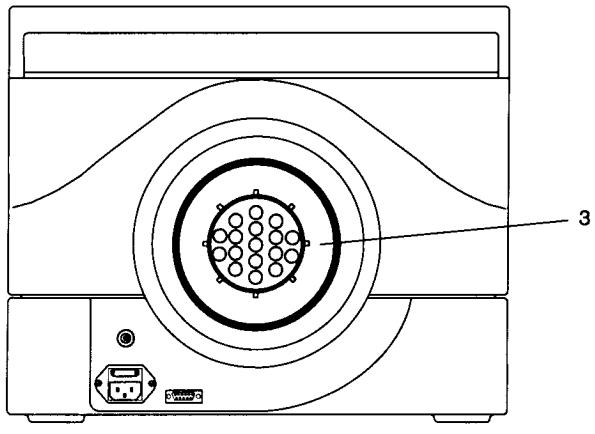

Fig. 2: Rear view of the RespiCare, removing the mount

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- Remove the fine dust filter/coarse dust filter (1) from its mount (2) and dispose of it as household waste.
- Place the new fine dust filter/coarse dust filter (1) in the mount (2).

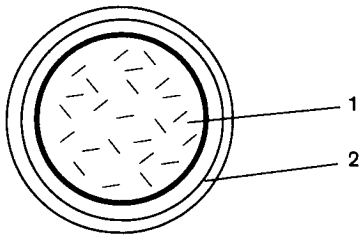

Fig. 3: View in the mount

- Secure the mount (3) by turning it clockwise into the RespiCare as far as it will go.

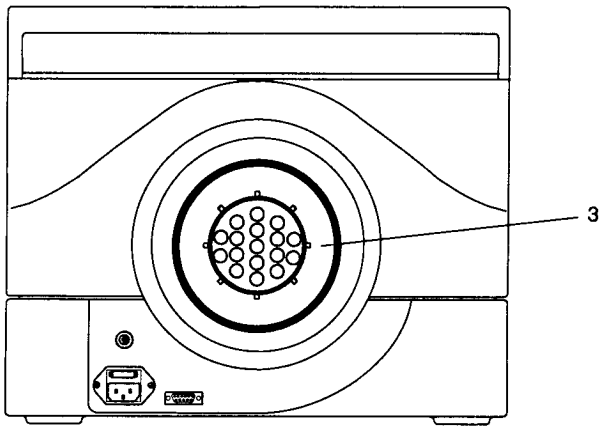

Fig. 4: Rear view of the RespiCare, securing the mount

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- Push the silencer (1) into the RespiCare.

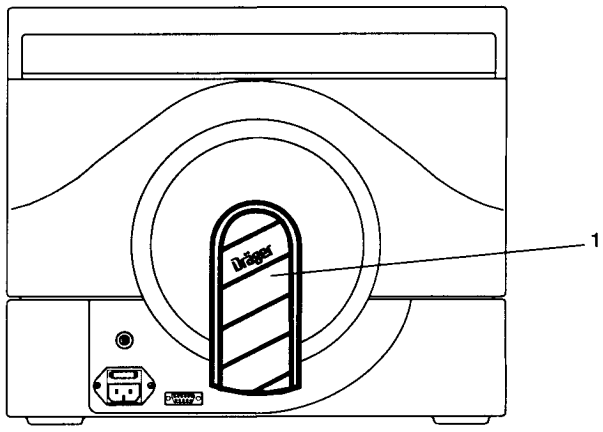

Fig. 5: Rear view of the RespiCare, mounting the silencer

- Enter the replacement date in the respective report.

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1 Fault-Cause-Remedy

Fault	Cause	Remedy
The red Alarm-LED flashes. The intermittent tone sounds.	Disconnection or stenosis.	Ensure that ventilation hose, test hoses, nasal mask are fitted without leaks or kinks.
The red Alarm-LED lights up continuously. The continuous tone sounds.	Equipment fault.	Call DrägerService ® or an authorized expert.
All LEDs off. The continuous tone sounds.	The fuse has blown. No mains power.	Replace fuse (see section 1 "Technical Data"). Check the main power.
Airway pressure is not reached during the inspiration phase.	Fine dust filter/ coarse dust filter clogged.	Clean the fine dust filter or preplace it. Clean the coarse dust filter or preplace it.
Airway pressure has increased significantly (RespiCare S und RespiCare SC).	Leak in pressure measuring hose or hose has slipped off socket.	Ensure that there are no leaks or kinks in the test hoses.
RespiCare does not switch over to pressure assistance in CPAP/ASB mode (RespiCare S und RespiCare SC).	Leak in the test hoses or hoses buckled.	Ensure that there are no leaks or kinks in the test hoses.
No pressure change in PCV (+) and PCV modes.	The pressure measurement is defective.	Ensure that there are no leaks or kinks in the test hoses.
Set pressure parameters too low after switching on.	The soft start function is effective.	Check setting of the soft start function.

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Changes

1 Type of Changes

Important:

This technical documentation is valid for the technical equipment status April 1997.

Type of Change	Date
New spare parts list - edition 04/99	11/99

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Appendix

1 Abbreviations

Abbreviations/Symbol	Meaning
ASB	Assisted Spontaneous Breathing
CPAP	Continuous Positive Airway Pressure
Freq	Ventilation frequency
Insp%	Percentage inspiration in the respiratory phase
mbar	Bar graph indication of the airway pressure (mbar)
min.	Bar graph indication of the time (minutes) for the Softstart function
Paw	Airway Pressure
Pexsp.	Expiration Pressure
Pinsp.	Inspiration Pressure
P-high	Upper pressure level
P-low	Lower pressure level
Patient	Patient usage counter
PCV	Pressure Controlled Ventilation
PCV (+)	Pressure Controlled Ventilation
PCV (S)	Pressure Controlled Ventilation Synchronized
T-high	Time for upper pressure level
T-low	Time for lower pressure level
Trigg. E	Expiratory flow trigger
Trigg. I	Inspiratory flow trigger
	Standby button for switching the fan on and off
	Switches the bar graph illumination on and off
	Suppresses the alarm tone for approx. 2 minutes

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Abbreviations/Symbol	Meaning
	Setting the time for the softstart
	Setting the time for the softstart
	Activating and confirming settings
	Making selections and settings
	Making selections and settings
	Red alarm LED
	Yellow LED for Service

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2 Spare parts list

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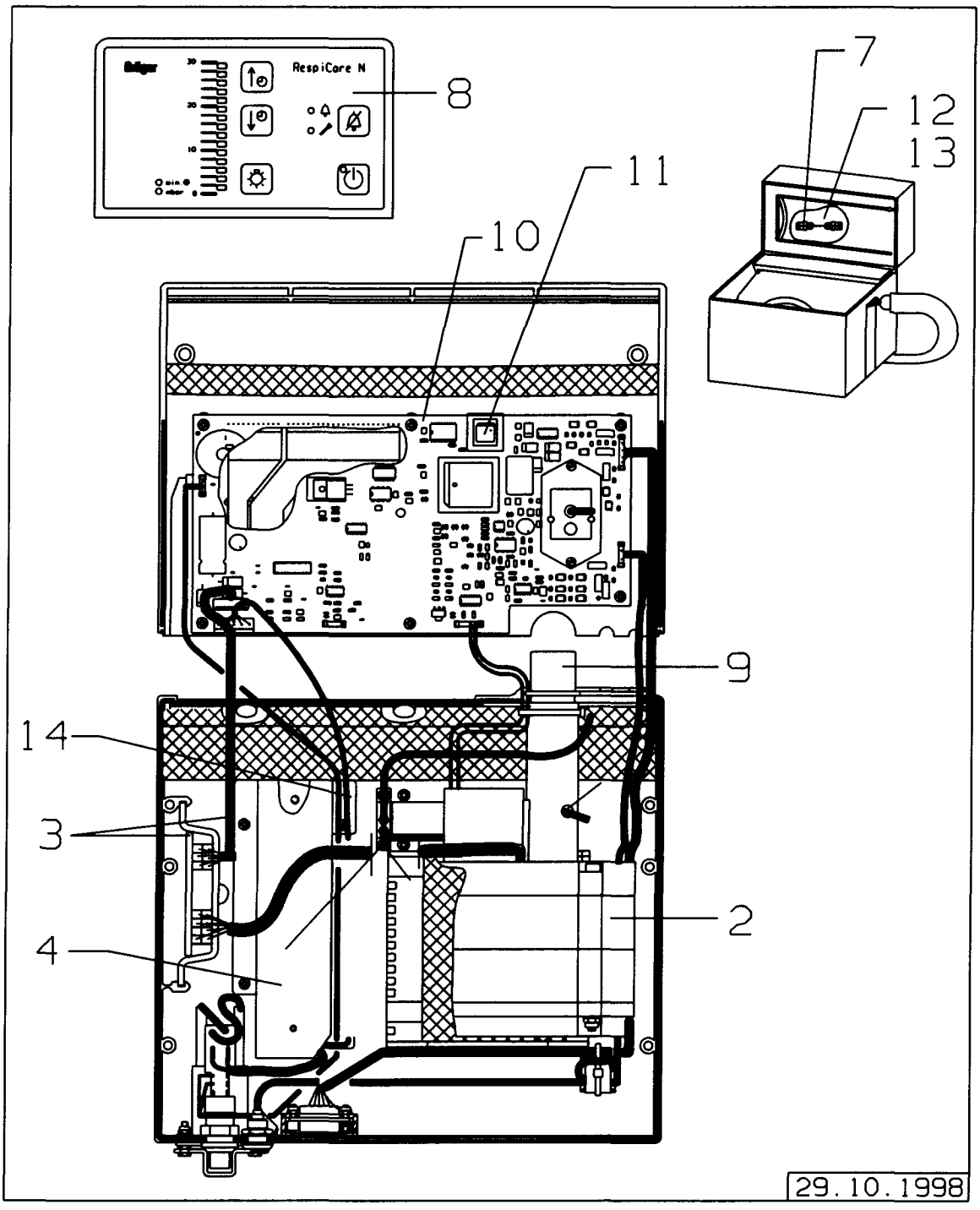
Diese Ersatzartikelliste gilt für Sachnummer:
This spare parts list is valid for part no.:

Sach-Nr. **Part No.**	**Benennung** **Description**
8413310	RESPICARE N RESPICARE N
8413320	RESPICARE S RESPICARE S
8413330	RESPICARE SC RESPICARE SC

Inhaltsverzeichnis der Bilder
Summary of pictures

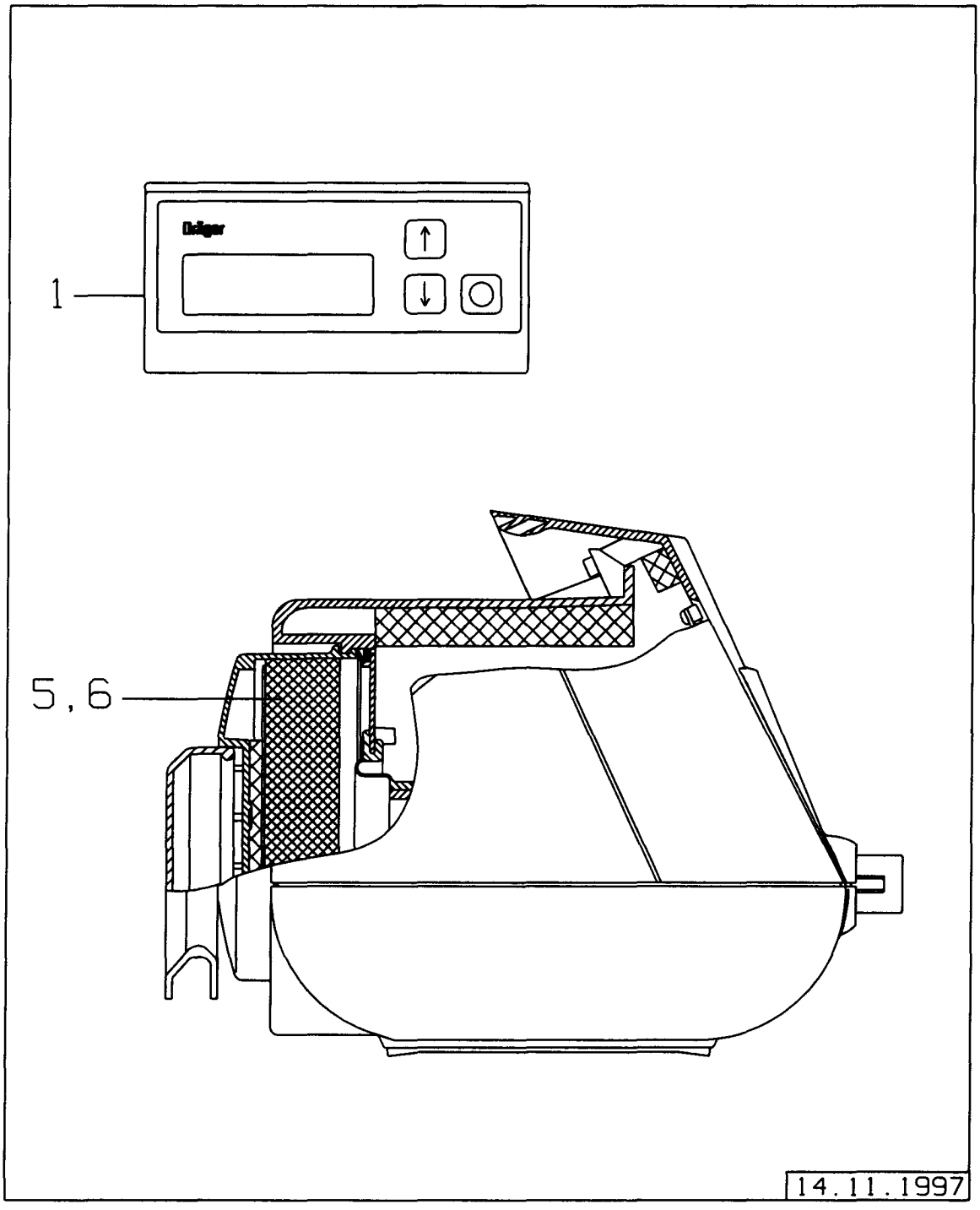
Bild Picture	Bezeichnung Description	Sach-Nr. Part No .	E-Liste Spare parts list
1	INNENANSICHT VERSION N INTERNAL VIEW VERSION N		
2	FRONT- / SEITENANSICHT FRONT / SIDE VIEW		
3	FRONT- / SEITENANSICHT FRONT / SIDE VIEW		
4	INNENANSICHT VERSION S/SC INTERNAL VIEW VERSION S/SC		

INNENANSICHT VERSION N **Bild/Picture 1**
INTERNAL VIEW VERSION N



FRONT- / SEITENANSICHT
FRONT / SIDE VIEW

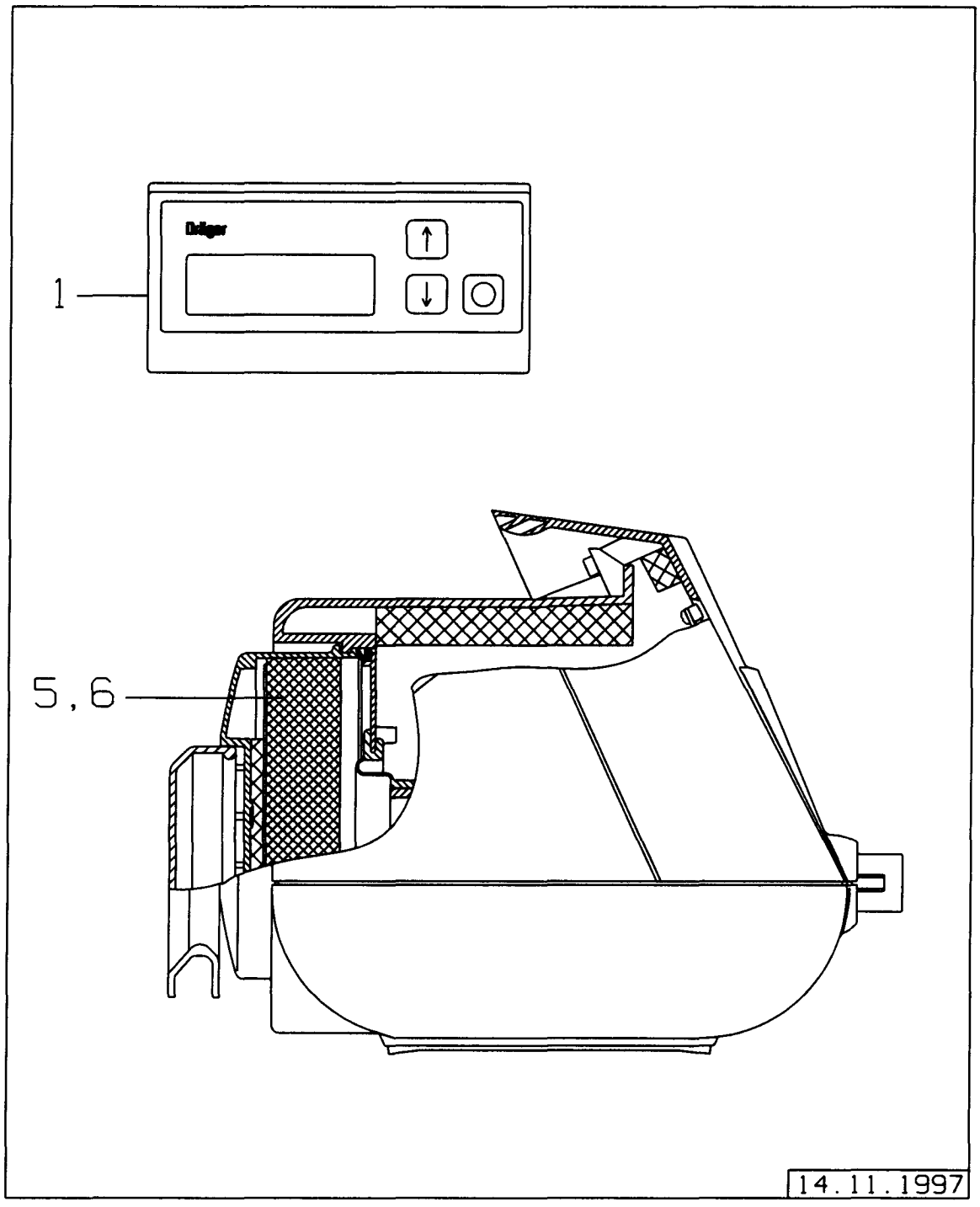
Bild/Picture 2



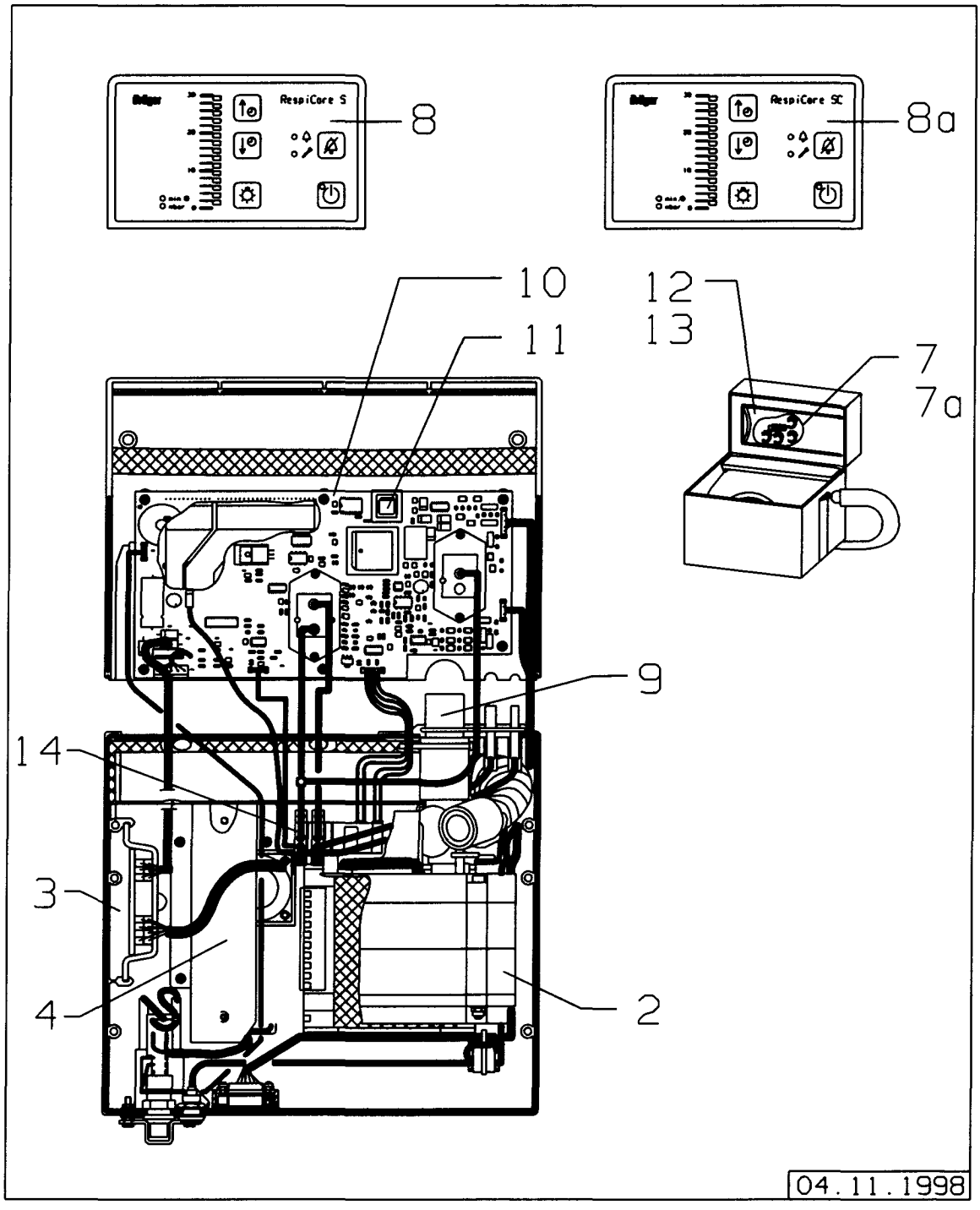
Position Item No.	Benennung Description	Sach-Nr. Part No.	Bestell-Nr. Order-Code	Packung Quantity
1 - 14	RESPICARE N RESPICARE N		8413310	
1	FERNBEDIENUNG REMOTE CONTROL		8413340	
1	SOFTWARE 01.00 RESPICARE FS SOFTWARE 01.00 RESPICARE FS	8413380		
2	GEBLAESE FAN		2M86058	
3	MOTORANSTEUERUNG, KPL. MOTOR DRIVE, CPL.		8413326	
4	NETZTEIL POWER PACK	8413984		
5	GROBSTAUBFILTER COARSE DUST FILTER		8413356	
6	P-FILTER BELAIR 33 P3-TMP3 P.FILTER BELAIR 33 P3-TMP3		6736400	5
7	SCHLAUCH 2,0M BREATHING HOSE 2 M		8413374	
8	FRONTFOLIE N FRONT FOIL N		8413346	
9	GASAUSLASS VERSION N GAS OUTLET,VERSION N		8413352	
10	BEST.LP STEUERUNG N PCB CONTROL SYSTEM N		8350491	
11	SOFTWARE 01.10 RESPICARE BG SOFTWARE 01.10 RESPICARE BG	8413415		
11	SOFTWARE 02.00 RESPICARE BG SOFTWARE 02.00 RESPICARE BG	2M86061		
11	SOFTWARE 02.20 RESPICARE BG SOFTWARE 02.20 RESPICARE BG	2M86297		
12	E-VENT N E-VENT-N		8413825	
13	MASKENANSCHLUSZ MASK CONNECTION		8413389	
14	3/2-WEGE-VENTIL 3/2-WAYS DISTRIBUTING VALVE		8413375	
	E-VENT N SET 50 ohne Abb. E-VENT N SET 50 without illu.		8413408	

FRONT- / SEITENANSICHT
FRONT / SIDE VIEW

Bild/Picture 3



INNENANSICHT VERSION S/SC **Bild/Picture 4**
INTERNAL VIEW VERSION S/SC



Position Item No.	Benennung Description	Sach-Nr. Part No.	Bestell-Nr. Order-Code	Packung Quantity
1 - 14	RESPICARE S RESPICARE S		8413320	
1 - 14	RESPICARE SC RESPICARE SC		8413330	
1	FERNBEDIENUNG REMOTE CONTROL		8413340	
2	GEBLAESE VENTILATOR		2M86170	
3	MOTORANSTEUERUNG, KPL. MOTOR DRIVE, CPL.		8413326	
4	NETZTEIL POWER PACK	8413984		
5	GROBSTAUBFILTER COARSE DUST FILTER		8413356	
6	P-FILTER BELAIR 33 P3-TMP3 P.FILTER BELAIR 33 P3-TMP3		6736400	5
7	SCHLAUCH 2,0M BREATHING HOSE 2 M		8413374	
7a	MESZSCHLAUCHSYSTEM TEST HOSE		8413343	
8	FRONTFOLIE S FRONT FOIL S		8413347	
8a	FRONTFOLIE SC FRONT FOIL SC		8413348	
9	GASAUSLASS, VERSION S, SC GAS OUTLET, VERSION S, SC		8413337	
10	BEST.LP STEUERUNG SC PCB CONTROL UNIT SC		8350496	
11	SOFTWARE 01.00 RESPICARE FS SOFTWARE 01.00 RESPICARE FS	8413380		
11	SOFTWARE 01.10 RESPICARE BG SOFTWARE 01.10 RESPICARE BG	8413415		
11	SOFTWARE 02.00 RESPICARE BG SOFTWARE 02.00 RESPICARE BG	2M86061		
11	SOFTWARE 02.20 RESPICARE BG SOFTWARE 02.20 RESPICARE BG	2M86297		
12	E-VENT E-VENT		8413391	
13	MASKENANSCHLUSZ MASK CONNECTION		8413389	

Position Item No.	Benennung Description	Sach-Nr. Part No.	Bestell-Nr. Order-Code	Packung Quantity
14	3/2-WEGE-VENTIL 3/2-WAYS DISTRIBUTING VALVE		8413375	

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Subject to modification.
Will not be replaced in the event of modifications.